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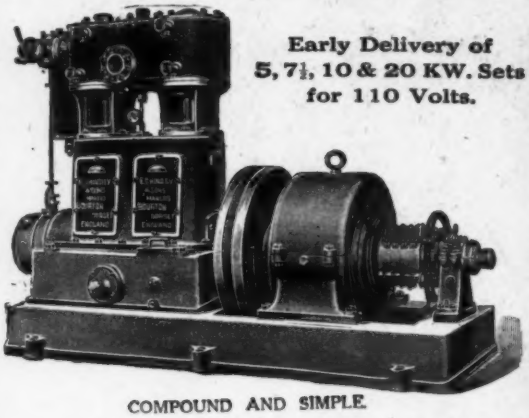

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THE

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ELECTRICAL REVIEW.

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ELECTRICITY SUPPLY TARIFFS.

THE two papers read before the Institution of Electrical Engineers by Messrs. J. R. Blaikie and J. W. Beauchamp have effectively drawn attention to a subject which, for 30 years a matter of absorbing interest to electricity suppliers, has latterly become not merely of supreme importance, but even a question of life or death to many undertakings. In other callings that have been subject to State control since the war, if the price has been fixed the trader has at least had the option of refraining from sale; or if he has been obliged to sell, he has been allowed to secure a fair price or its equivalent for his wares; but the electricity supplier is between the devil and the deep sea—the maximum price of his product is fixed, and he is compelled by statute to supply all comers at that price or less. We have pointed out on various occasions that under the existing conditions these obligations press so hardly on the smaller undertakings that it is absolutely impossible for them to make ends meet; in the case of the municipal undertakings the inevitable deficit will have to be made good out of the rates, which are already at an excessive pitch, but the small companies are in a still graver plight—they are faced with bankruptcy. Many of them have a waiting list of would-be consumers whose demands, according to law, must be satisfied, for which purpose the plant and mains must be extended at present prices—an absurd proposition when they are actually unable to pay their way with the existing low-priced plant.

Obviously the situation is an impossible one, and it is incumbent upon the Electricity Commissioners to find a way out of it with the least possible delay. As Mr. Ll. B. Atkinson pointed out when a deputation from the British Electrical Development Association waited upon the Commissioners in November last, people are anxious to have a supply of electricity, and would rather pay a high price for it than be deprived of it altogether—the latter event would, indeed, be an anti-climax under the *régime* of a Board of Commissioners appointed to promote the supply of electricity throughout the length and breadth of the land! Six months have elapsed since that interview, at which the situation was fully explained to the Commissioners; we do not suggest for a moment that they have neglected the matter, but it is the plain fact that the situation is the same to-day as it was then. The trouble arises entirely from the rigid control imposed by the statutory provisions which cannot be varied without reference to Parliament. In the United States, the tariffs are supervised, as we recently explained, by local "Public Utility Commissioners," and in this country they should be placed under the discretionary powers of the Electricity Commissioners. Provision is made to this end in the Electricity (Supply) Bill, but the revision can only be made at triennial intervals, and as in many cases this would involve further delay, that provision is inadequate. There is also a considerable risk of failure to pass the Bill. Hence the Commissioners should secure powers independently of the Bill, for the matter is very urgent.

As regards the form of the revised tariffs, the subject has been exhaustively studied during recent years, and the consensus of opinion is overwhelmingly in favour of a tariff which shall take separate account of the fixed charges and the running cost of the supply. The arguments in favour of this type are unanswerable; more than any other sound economic tariff, it tends to develop

the use of electricity for the most diversified purposes, while it ensures that even the most unprofitable class of consumer shall contribute a fair proportion to the income of the undertaking. It has been shown that some consumers would be unprofitable even if they paid 1s. 9d. a kilowatt-hour.

It is well that the industry should fully understand what is meant by the present conditions. Small undertakings are unable to raise fresh capital; extensions cannot be carried out; manufacturers and contractors receive no orders from these undertakings; the price of energy for heating and cooking is deliberately put up to prohibitive values with the express object of preventing consumers from increasing their demand and overloading the plant! It can hardly be wondered at that when the small undertakings were forced into the adoption of such methods to keep their stations running, an impression developed that the Commissioners wished to crush these undertakings out of existence, to make way for new schemes. That view has been indignantly repudiated by the Commissioners; but unless their efforts to bring about improved conditions are quickly successful, the same result will ensue. Small undertakings cannot "live on their losses."

THE PARALYSIS OF INDUSTRY.

At the moment of writing, the coal dispute has dragged its weary length along for close upon eight weeks, and it is to be hoped that the miners, the owners and the Government are by now sufficiently alive to the extent of the damage that the country is suffering, or to their responsibility for it, to make some real and effective attempt to bring it to a conclusion.

The extent to which British prosperity depends on coal would appear not to be generally realised. It is not so much that coal itself forms a convenient and quickly-handled cargo with which to load ships on their outward voyages. Many economists consider that coal is too precious to be exported, and that our whole handling of coal is wasteful in the extreme. Coal is a reservoir of valuable chemical products, of which two, coke and gas, are fit only to burn. To burn, or sell, the whole precious thing is a wasteful process of which any engineer should be ashamed. We must pay for our imports by exports, but those exports ought to be goods manufactured here by the aid of the coal with which we are providentially endowed. Sir Robert Hadfield says the world is hungry for steel. What nation is better fitted to satisfy the world hunger than Great Britain? Yet we stand idly by and leave the coal down in the mines. Let it be understood and appreciated that our trade has fallen off to such an extent that it is no longer capable of maintaining the population of these islands, even at the pre-war standard of living, let alone that better standard for which we were taught to hope.

During the war the nation proved itself capable of the highest possible degree of organisation. If we can organise successfully for destructive purposes, why not for constructive? There was much that was wrong in our war-time organisation; much that was wasteful and inefficient. But there was more that was right and good; more that was efficient and economical, in the true sense of the word. If we had lost the war, there can be little doubt that the Germans would have come here and we should have been organised, willy-nilly, for the production of whatever they chose to demand. Having proved ourselves equal to the accomplishment of a great purpose, is it not seen to be a miserable shame that we cannot, or will not, at any rate we *do* not, set ourselves resolutely to the accomplishment of a far greater purpose? For peace is greater than war. The demands of the populations of the world are greater than the demands of the greatest army. The duration of peace is longer, we may hope, than the duration of war. The feeding and clothing and housing of the nation's children is a bigger business than the feeding and clothing and housing of the nation's soldiers. Then why don't we get on with the job?

The misery of the unemployed, of their wives and children, is less spectacular than the distress of a mighty army, driven backwards by the lack of means to advance or defend itself. But it is equally, or more, important that the nation should supply their needs; and, what is more, it is the purpose immediately to hand. The discipline of the war taught us all that *now* is the only time. A book, reviewed in our columns recently, said that "to-day's need is production; to-morrow's need will be selling." To-morrow has come, and the need of to-day is to get business. We can only get business if we will pay for our necessary imports with exports at a reasonable price. Our cost of production must go down. The way to reduce cost of production is to increase production. It is not necessarily the case that wages form the chief item in production costs. American wages are notoriously higher than British; yet, even at an adverse exchange, American goods are frequently cheaper, in overseas markets, than British. Considering the country as a business proposition, is it not obvious how our overhead costs are increasing during the hold-up of industry? We simply *must* get back to work, and recognise that goodwill between classes is the only way to prosperity.

For the settlement of the coal question the authorities are feeling their way toward a new solution. For other industries, let Whitley Councils be encouraged. The machinery of industrial peace has largely been thought out and prepared. It is the application of the principles which would set the machinery in motion that is lacking. In Heaven's name, let us do something now!

Individual Responsibility and Leadership.

There never were so many capable minds at work trying to solve the industrial wage problem. This fact alone should fill us with hope that both the right spirit and the right way will soon be found. It is useless to imagine that we are going to get over our difficulties if all we have to say is "wages must come down!" It must be understood that there is an all-round responsibility and duty. If big cuts in wages are not desirable, let the reductions be as large as they can be as the result of agreement. What neither the "working man" nor the employer can afford to overlook is the zeal of Continental workmen, and their large output for comparatively low wages. We must have our efficiency at its maximum and our costs at their minimum. Wherever it is possible we must, as Major S. G. Howard, M.P., has recently remarked, seek relief in improved methods of production by up-to-date machinery and a larger output by labour. We recognise that there is nothing new in these reflections. But we cannot secure maximum efficiency and output without the co-operation of all interests. We agree that it is better to ask for a bigger output for the same wages than to ask labour to take lower wages for the same output. When will the far-seeing minds in the unions bring their influence to bear upon the mass, and show them that the unpractical idealism of some and the deliberate destructiveness of others are doing serious injury to the interests of millions of men, women, and children? There is sometimes a call for leaders who will point out the way of sanity and safety, for spiritual leaders who will guide us with regard to the application of great Christian principles in our industrial relations. We believe that human leaders are not the need. Human leaders are discredited at present; each has his own limited following; none influences all; but we may each exercise our individuality for moderation. Deeply in the minds and hearts of the British people there are rooted sound principles which are themselves influential leaders of the race. It is known well enough what is the right thing to do. Part of the failing lies in our unwillingness to follow the leadership that reigns within.

Smokeless Air.

Letters written to *The Times* by artists and architects have recently drawn attention to the extraordinary clearness of the atmosphere of London, due to the absence of smoke. We have ourselves observed that the views of London and its surroundings which can now be obtained from elevated points far surpass anything within our experience, and we are glad to record that the miners' strike has thus conferred upon us one beneficial result, even if it be of no material value.

Apart from the æsthetic aspect, however, there is a very substantial gain to be derived from the purification of the air, based upon several factors—improved health, reduced expenditure of time and labour on the cleansing of houses and clothing, lessened cost of renewing decorations, and, perhaps the most important of all from the financial point of view, reduced wastage of buildings and other structures due to the destructive effects of the products of combustion. It is to the last-named item that the architects especially direct attention, urging that having experienced the benefit of clean air, we should take steps to make the reform permanent, by abolishing the use of soft coal and substituting for it gas, electricity, and hot water.

The difficulties in the way at this time are admitted; the proposal is on the same footing as many others—railway electrification, the development of electricity supply, the utilisation of water power, &c.—namely, that if the capital were available to carry it into effect, the return on the outlay would be abundant; but the capital is not at command. The nation is impoverished, and must be content to walk warily for a time.

The Electrical Wages Dispute.

The sections of the Electrical Trades Union which ceased work to prevent a reduction in their wages have, after a short time, seen reason, and have returned to work upon the terms arranged between their union and their employers. A further conference is being called at the end of the present month, whether to confirm the tentative agreement, which apparently has not yet been officially repudiated by the E.T.U., or to postpone the date of the second stage of reduction, we know not. It is clear, however, that the other unions comprised in the Federation of Engineering and Shipbuilding Trades were not disposed to render active support to the electricians, and, indeed, even their sympathy was rather a doubtful quantity. This was not to be wondered at, having in mind the simple fact that they (the other unions) had already accepted certain reductions. The spectacle of workers on reduced wages losing even these to sustain the wages of other workers at the same level would have been too ridiculous to contemplate.

Rumour has it that the collapse of the strike was largely due to the flat refusal of many members of the E.T.U. to engage in it; that they are utterly sick of the incessant attempts of their leaders to involve them in strikes, and that there is a rod in pickle for the Executive of the London Branch. However that may be, we trust that a real and lasting settlement will be arranged at the next meeting with the employers.

The I.M.E.A. Convention.

Members of the Incorporated Municipal Electrical Association, and prospective visitors to the annual Convention, will learn with regret that owing to the prevailing conditions, over which they had no control, the President and Council have been reluctantly compelled to cancel the Convention for this year. Their disappointment will be mitigated to some extent by the fact that, for some time past, they must have felt misgivings on the subject, but none the less, the abandonment of this always enjoyable and exceedingly useful meeting will for many mar the memory of the coming summer. No one will more keenly regret the necessity of the decision than the President, Major Richardson, who with the aid of the Dundee Local Committee has exerted every effort to avoid it. If we remember aright, this is the second occasion on which he has been deprived of the pleasure of welcoming the Convention to his own town, and we extend to him our sympathy. We hope that at the annual general meeting (to be held in London on July 22nd), and at the annual dinner on the previous evening, the members will be present in great force, as the next best thing to holding the Convention.

German Competition in Norway.

About a year ago a Norwegian contemporary raised the question of the prejudice caused to the native electrical manufacturing industry through Norwegian supply works placing orders with foreign firms, particularly German and American. The newspaper now draws attention to two fresh instances in which unfair treatment has been meted out to Norwegian firms through Germans being permitted to revise their offers after the tenders had been opened. In the first place, the Christiania municipal electricity works is about to obtain a further supply of power from the Rjukan hydro-electric works, and tenders were invited for two synchronous machines and apparatus for this purpose. Offers were received from Switzerland, Sweden, and Norway, and from two German firms. The Swiss tender was for 995,000 kronen, the Swedish 674,000 kr., and the Norwegian 693,000 kr., while the German offers were 560,000 kr. and 530,000 kr. respectively. After the tenders had been opened and the competitive prices disclosed, the Germans offered to reduce their prices considerably. Instead of refusing to entertain the modified proposals, the Christiania authorities drew the attention of the Norwegian firm to them, and offered the latter the contract, but the bottom price to which the Norwegian firm could go in order to cover its expenses was 15 per cent. higher than the lower of the German initial tenders. Under the circumstances the municipal authorities accepted the German tender, which had been reduced from 530,000 kr. to 400,000 kr. Is it any wonder that the Christiania contemporary declares that this is an example of public authorities taking advantage of amended tenders, submitted after the original quotations had been announced, in order to depress prices, and that this is a course of procedure which is inconsistent with the business customs of first-class firms? The second instance mentioned is attributed to the Vestfold Power Co., which obtained tenders for plant. The lowest German offer was 60,000 kr., and the Norwegian was 69,000 kr. A representative of the purchasing company visited the works of the Norwegian firm, and everything seemed to be in order, when the German firm lowered its price to 40,000 kr., one half of the Norwegian cost of construction, and secured the order.

The Christiania *Norges Handelstidende* states that it is hopeless at present for Norwegian industry to try to compete with Germany. The wages in the latter country are about one-third of those paid in Norway, and the general expenses about one-fifth. Even raw materials are lower, as the Germans are largely buying scrap from abroad and working it up into manufactures. According to its capacity, Norwegian industry has fought against this insane competition. In the second case the Norwegian firm quoted at a price which not only would not have yielded any profit, but was 15 per cent. under the cost of production. The newspaper submits that a time limit for tenders should be fixed, and no regard paid to any subsequent offers that might be received.

It is of interest as bearing on the question under consideration to hear what the Norwegian *Tidens Tegn* has to say. Referring to the report that Herr Hugo Stinnes proposes to obtain a firm footing in Danish industry, the newspaper states that this German is already manifesting great activity in Norway. An import coal and iron business already exists in Christiania under the title of Hugo Stinnes, and through the Siemens-Schuckert works in Christiania, which is closely associated with him, he is to become a keen competitor in the electrical industry in Norway.

A COUNTRY HOUSE HYDRO-ELECTRIC INSTALLATION.

In view of the interest that has been awakened in hydro-electric schemes, the following particulars of a complete electric house installation near Oban, Argyllshire, may be acceptable to our readers.

The stream from which the power is derived drains a large catchment area, about a mile wide and two miles in length, the hills, shown in fig. 2, rising on either side to over 3,000 feet. Owing to the heavy rainfall in the district, it was thought that there would be sufficient water flowing in the stream even in the dry season, without the expense of constructing a reservoir, and this in practice has proved to be the case.

Fig. 1.—Weir and Pipe Line.

The amount of water required was 85 cubic feet per minute, and after six weeks' drought it was found that not less than 50 cubic feet of water per minute was passing through the turbine and giving fully half load. At other times after heavy rain as much as 1,000 cubic feet per minute was flowing. A substantial concrete weir was therefore built across the stream to act as an intake; fig. 1 shows this weir and the pipe line coming from it. A scour valve and pipe are provided for cleaning out the bottom of the stream. The concrete wall is about 6 ft. high, and has an overflow 9 ft. wide by 6 in. deep. In times of spate the water comes over anything up to 12 in. above the weir, over the full width of the stream.

The pipe line, which is about 2,000 feet long and almost straight, only three 150 deg. bends being used in its construction, is carried underground to the turbine house situated on the bank of the stream and at a distance of about 50 yards from the dwelling house, which is illustrated in fig. 4. The estimated difference in level between the intake and the turbine house was 287 feet. It is interesting to note that after completion the head, according to the pressure gauge fitted on the turbine, was 290 feet.

The pipe line consists of 8-in. bore, No. 7 gauge, lap-welded steel tubes, coated with preservative compound, with socket joints, the whole being wrapped with hessian cloth and re-coated. The joints were made with lead and yarn, and the pipes were in lengths of about 18 ft. each. Owing to the very rough nature of the ground a considerable amount of blasting and deep digger work was entailed, and it was also a difficult matter to get the pipes into position on the rough hillside. A small existing building on the river bank with some slight alteration has made a very good power house, fig. 3, and in this are fitted the turbine, dynamo, and switchboard and the necessary controlling valves.

The turbine, which is of Messrs. Gilbert Gilkes & Co.'s make, is capable of giving 33 b.h.p. or 22 kW at full load at about 650 revs. per minute, with an estimated net head of 268 feet at full load, there being a frictional loss of 20 ft. when passing 85 cubic feet per minute.

Owing to the fact that the water is taken directly from the stream, there was no object in fitting an economiser, but a 6-in. sluice valve is fitted with a slide on which is marked the position of the valve for the various loads. This is really only used if the water flowing in the stream is less than the full capacity of the pipe.

The turbine is fitted with a relief valve, a pressure gauge marked in feet and pounds per square inch, and a patent shaft governor consisting of a spring pendulum mounted on the shaft and coupled to the slipper deflector by means of a rocking shaft and levers. The operation of this governor is extremely quick and efficient. It was found on test with the spear valve three-quarters open, the dynamo giving 90 amps. at 255 volts, that on all the load being thrown off, the pressure only rose to 270 volts, which was practically due to the 5 per cent. rise in speed of the turbine. In a similar way, when the full load was thrown on again, the voltage dropped to 255.

The dynamo, which is directly coupled to and on the same bedplate as the turbine, is of Messrs. Horace Green & Co.'s make, compound wound and designed to give 85 amps., 270 volts at 650 revs., and no load at 265 volts at 680 revs. with all shunt resistance out, and the

Fig. 2.—The Water Shed.

Fig. 3.—Turbine House.

Fig. 4.—The House.

plant behaves extremely satisfactorily in operation. It was found that with the spear full open 100 amperes at 250 volts was easily obtained, and this 15 per cent. overload was maintained for an hour after a six hours' run at full load, the dynamo being perfectly cool at the end of the test.

The plant runs continuously night and day, and no batteries are installed, which makes the switchboard arrangements extremely simple. On the switchboard in the power house an 8-in. dial ammeter and voltmeter, shunt regulating switch and main switch and fuses are fitted, and from this to the house a concentric 19/.083 paper-insulated lead-covered and armoured cable is run underground.

The switchboard in the house has mounted on it a voltmeter and an ammeter with red marks at 250 and 85 amps. respectively, and also a 100-amp. Ellison circuit-breaker. This breaker is set to come out at 100 amperes, and cuts off everything throughout the house with the exception of the lights, which are not controlled by it. In the event of the breaker coming out, some piece of apparatus has to be switched out, as although the average maximum current is only about 70 amps., the actual amount of apparatus which could be switched in would take about 130 amps.

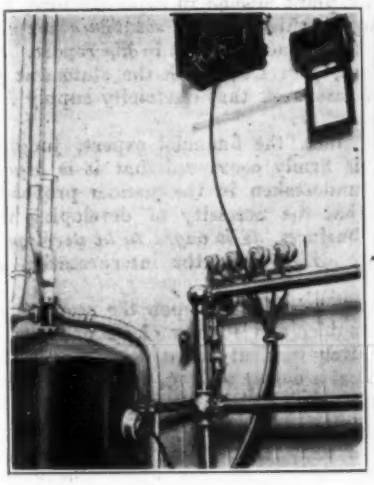

Fig. 5.—Hot Water Tank.

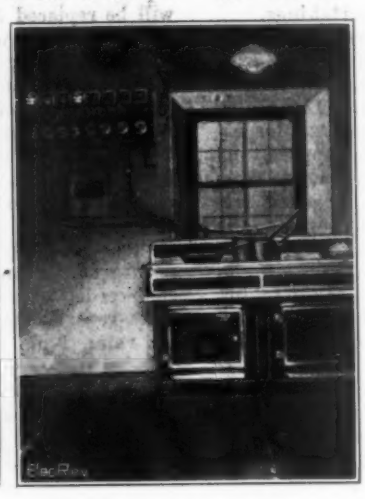

Fig. 6.—Cooking Range.

In the mansion house, lighting, cooking, hot-water heating, heating and drying are all electrical, and from 50 to 60 tons of coal are saved annually at a cost of £2 or £3 a year for lubricating oil, if the capital cost is written off, and even if it is not, the scheme shows quite a good return on the money invested, the house being about five miles from the nearest station, and the cartage of coal therefore being an expensive item. Throughout the house, &c., there are over 100 lamps and sockets. The installation was carried out with the Henley patent wiring system.

In the kitchen a cooking range by the Falkirk Iron Co., shown in fig. 6, is fitted, consisting of two ovens, hot cupboard, grill and six boiling rings, each of which is fitted with a ruby pilot lamp, a fuse, and a three-heat control switch; the ovens are fitted with thermometers. The total loading of this range, which is nickel plated finished as to the hot table and white porcelain enamel as to the ground plate, is 13.6 kW.

The cooking on this range is extremely efficient, and the cook who is operating it, although at first rather prejudiced against it, would not now care to go back to the old coal range after about six months' experience.

The hot water supply for the house is got from an electrically heated 45-gallon tank, which is both boiler and storage tank. That is shown in the illustration, fig. 5, and is placed in the bathroom, which room is kept warm. Four electrical elements are fitted in this tank, each loaded to 1,500 watts. The lower three of these elements are connected up through a 3-way distribution board to a clapper switch and thermostat set to operate automatically at about 160 deg. to 170 deg. F. When the temperature falls, say, 5 deg. below this, the current is automatically switched on, and in a short time, when the temperature rises again, the current is cut off. In addition, the fourth or top element is controlled by a 10-ampere Hart d.p. switch, and with the four elements in circuit it is found that the water is raised from cold or, say, 45 deg. to 160 deg in about two hours' time. There is thus obtained an abundant supply of very hot water at any time of the day or night, and three successive hot baths can be taken if required. This is one of the most satisfactory parts of the whole installation, and has run perfectly since it was installed.

Throughout the house there are fitted 24 10 to 12 amp. heating points, and 3-kW fires are used in the various rooms. No coal is therefore required at all, and if in addition to the electrical heating, which is very efficient, any fire is wanted, wood is burned from the estate; in the garage provision is made for a 10-h.p. motor and saw bench for cutting the wood.

The drying room is a small room about 10 ft. 6 in. by 7 ft., and is heated by means of three tiers of 2-in. cast-iron pipes on three sides. These pipes are supplied with water from the ordinary cistern, and heated by one 1,500-watt element, which is continuously kept in circuit. The temperature of the room is usually from 90 to 100 deg. Fah., and it is found from practice that thoroughly wet clothes put into the room at night are quite dry in the morning. This is found of great usefulness for shooting parties, as the district is rather a wet one.

In the garage, where the supply is by overhead cable, a suitable charging board for motor-car batteries is fitted, and throughout the house various apparatus, such as a vacuum cleaner, irons, kettles, hot plates, an egg boiler, &c., for various household requirements, are fitted.

The whole scheme was designed and carried out by Messrs. Allan Arthur & Ure, electrical contractors, Glasgow, and has been running with complete satisfaction since the beginning of November. Such a scheme where water power is available is an ideal one, especially for houses that are situated at a distance from a station where the cartage of coal is inconvenient and expensive, and in the Highlands should appeal to many.

The Electrical Energy in Thunderstorms. — Having defined a thunderstorm as an electrical machine, Mr. C. T. R. Wilson continued an explanation of this machine in his second lecture at the Royal Institution on April 14th. As a thundercloud moved across the country, the conditions, he said, would change as it passed over grass, forest, water, or snow. The current between the ground and the cloud varied according to the nature of the ground below. The very important question arose as to the number of storms that were going on at a given moment. This it was difficult to answer. In many parts of the world thunderstorms were of daily occurrence. If he tried to form an estimate of the number in progress at a given time he thought a thousand would be an underestimate. A thunderstorm was wasting energy in lightning flashes at the rate of one million h.p., but it was a difficult matter to say if that energy could be saved.

Apart from this wasted energy there was the question of the total transfer of electricity that took place between the ground and the upper atmosphere. Remembering the thousand thunderstorms there was probably something far exceeding a thousand amperes carried between the ground and the upper atmosphere in the showers. An important question was whether these currents were mainly currents of positive electricity going upwards or currents going in the opposite direction. Probably storms tending to produce currents of both kinds existed.—*Morning Post.*

THE ELECTRICITY SUPPLY BILL.

(COMMUNICATED.)

THE old saw that "one tale holds good until another is told," applies with special force to the much-talked-of Electricity Supply Bill, and while there is no doubt that the Editorial in the last issue of the REVIEW contains some questions which are debatable, I hope to show that there are certain fundamental matters in connection with the unification of electricity supply which scarcely admit of debate, as upon the evidence which I propose to give, the conclusion is obvious.

In order to obtain a clear understanding of the present position it is necessary to trace the growth of the super-station idea from the beginning. Many years ago, several private Bills were brought before Parliament promoting schemes for supply in bulk to London. With one exception, all these Bills were thrown out, because it could not be shown that the supply under the schemes could be produced at a lower rate than that already being given by the existing authorised undertakers, *and this was at a time when wages and the cost of materials were at their lowest*, both for the bulk supply schemes and for the existing undertakings.

For some unknown reason the super-station idea, however, continued to grow in favour, until in 1918 the Board of Trade appointed a committee to investigate the whole question of electricity supply. The report of that committee duly appeared, and consisted largely of opinions, with little or no evidence in support, and a series of recommendations mainly based upon those opinions. One statement was, however, repeated frequently, and with this everyone probably agreed. It was to the effect that a cheap and abundant supply was essential.

In paragraph 56 of the report (referring to the taking over of stations owned by existing authorised undertakers) appears the following:—

"An undertaking should in such cases be given that electricity will be supplied to them *at least as cheaply* as they could have produced it themselves in similar circumstances of coal, labour, and other costs, including capital charges, with their existing plant and output."

The main recommendations contained in this report appeared in the Bill of 1919.

Clause 7 of the Bill provides that when a station is taken over except by agreement, the district electricity board shall be *under an obligation to supply at a price not greater than* that at which it could have been so generated.

It is well known that the compulsory clauses, as well as the financial clauses of the Bill were withdrawn, and did not appear in the Act of 1919. It is also somewhat suggestive that the words "at least as cheaply as" and "at a price not greater than" were also omitted from the Act and the following substituted:—

Section 8 (1): "It shall be the duty of every Joint Electricity Authority constituted under this Act to provide, or secure the provision of *a cheap and abundant supply of electricity* within their district."

It would, therefore, appear that the promoters of the Bill were doubtful whether the Joint Electricity Authority, with its super-stations, could supply as cheaply as the existing authorities.

In the present Bill (Clause 13) appears the following:—

"The prices charged for electricity by a Joint Electricity Authority shall be so fixed by the Authority . . . that over a term of years, to be approved by the Commissioners, their receipts on income account shall be sufficient to cover their expenditure on income account (including interest and sinking fund charges) with such margin as the Electricity Commissioners may allow."

In the London area it is proposed to scrap 60 out of 77 existing stations, and if the Bill before Parliament is passed, a Joint Electricity Authority, with its super-stations, will be the only source of supply, and should it be found that it cannot supply as cheaply as the scrapped stations could have done (*which is inevitable*), the price of electricity will have to be raised to any figure that will enable the Joint Electricity Authority to make both ends meet.

It must be remembered that unless the price of electricity compares favourably with that of other forms of power, electricity will have to go under, and it will not be possible *to prove* whether or not the super-stations can supply at a lower price until all the other stations are shut down.

It is, however, possible by reading the report of the financial expert on the scheme for the London area to form a fairly safe opinion.

The generating plant of the 60 stations above referred to, and which it is proposed shall be scrapped, consists largely of modern machinery of an efficient type purchased at pre-war price. This is stated in the technical report of the London scheme. The plant referred to will be replaced by plant erected in super-stations, the capital charges upon which will be *six times pre-war cost* as stated by the financial expert in his report.

I must, therefore, join issue with the statement in your Editorial of last week that electricity supply *has ceased to be speculative*.

As a matter of fact, the financial expert, judging from his report, is firmly convinced that it is *highly speculative* when undertaken in the manner proposed.

I quite agree that the necessity of developing the electricity supply business, *as it ought to be developed*, is urgent. I only differ upon the interpretation of the words.

As regards money being spent upon the security of the rates, I am unable, and I know of no one who is able, to state definitely to what extent the rates may be liable, in the event of a deficit arising, in case the Joint Electricity Authority is unable to produce at a reasonable figure, and thus loses the commercial market for this form of power, but it may be a very considerable amount. The constitution of the Joint Electricity Authorities is such that they are not answerable directly to the ratepayers, and this alone renders their formation highly undesirable, more especially as they will have the spending of large sums of money, which do not come out of their own pockets, and in which they are not directly interested.

If the supporters of the Bill have the courage of their convictions, let them induce the promoters to include two clauses in the Bill: (1) to the effect that the rates shall on no account be charged with any deficit due to the operations of a Joint Electricity Authority; and (2) to the effect that no station of an existing authorised undertaker shall be prohibited from continuing to develop by putting down additional plant, unless a supply can be obtained *at a lower cost* than it can be generated at if the additional plant is installed.

Your Editorial states that if the financial clauses of the Bill are rejected it will "throw the whole business into the hands of the companies."

To quote your own Editorial: "This is pure nonsense" as there are no compulsory clauses either in the Act or the Bill, and therefore no existing undertaking could be compelled to take a supply from a company, and if the Clause (2) referred to above were inserted in the Bill every existing individual undertaking would be protected as well as the supply business in general.

Your Editorial states that "*The reform of London's electricity supply depends upon the passing of the Bill.*" I have tried to discover what this "reform" refers to. Your Editorial, referring to Joint Electricity Authorities, states that "the essential characteristics of the Joint Authority" scheme are to be found in active operation in France and Germany. If this refers to

electricity undertakings, the illustration is ill chosen, as in statistics published in 1913-14 the average price per unit sold in London *without any traction load* was for the local authorities 1.75, companies 2.36, total 2.13 pence; Paris 5.10, Berlin (with big traction load) 1.70, Hamburg 3.08 pence.

I will paraphrase your Editorial remark by stating my emphatic opinion that the *success* of electricity supply in the immediate future depends upon the financial clauses of the Bill being deleted and the clause (2) referred to above being inserted and passed.

I agree entirely with the final lines of your Editorial as to "the prime necessity of a cheap and abundant supply of electrical energy throughout the whole country," provided the words "cheap supply" mean "at least as cheaply as it can be produced by the existing undertakings."

THE INSTITUTION OF ELECTRICAL ENGINEERS.

The Council's Annual Report.

The Council of the Institution at the forty-ninth annual general meeting, to be held on Tuesday next (May 31st), will present its report for the year 1920-21 in which the continual growth of membership is emphasised; nearly 200 Post Office electrical engineers joined the Institution during the session. The membership on April 1st, 1921, was composed of 9 hon. members; 1,679 members; 4,605 associate members; 805 graduates; 1,897 students; and 454 associates, a total of 9,449, or an increase of 1,303 during the year; 45 members died, 135 resigned, and the membership of 35 lapsed during the year. Five candidates submitted theses during the year in lieu of the associate membership examination, and 19 honours and distinctions were conferred on members, including five knighthoods. During the past 12 months the numbers of meetings held were as follows: Ordinary, 17; special, 2; wireless sectional, 3; informal, 9; council, 16; territorial centres and sub-centres, 98; students', 47; committees, 139. Twelve addresses and two lectures were delivered, and 15 papers were read; in addition a number of papers have been accepted for publication in the *Journal* without being read at meetings. There are seven territorial centres, seven sub-centres, and four provincial students' sections in existence, as well as three local centres abroad (Calcutta, Hong-Kong, and Argentina), and there are local hon. secretaries and treasurers in 18 countries abroad. There are 15 standing committees, five sectional committees, and six special committees, and the Institution is represented on 33 bodies. The Council awarded eight scholarships valued at £50 and one valued at £25 each, tenable for one year.

The question of erecting a suitable memorial to the members who fell in the war could not be dealt with during the past year owing to the absence of the Institution from its building, but will be taken up by the War Memorial Committee as soon as it is possible to select an appropriate position in the building. In the meantime, the task of collecting data for the biographical notices to appear in the war memorial book has been in progress, and the benefaction of £2,000 five per cent. war loan referred to in the last annual report has been constituted as a trust fund under the title of the War Thanksgiving Education and Research Fund (No. 1), the trustees being Sir James Devonshire, K.B.E., Mr. Roger T. Smith, and Sir John Snell. A grant of £100 for educational purposes has been made this year by the Council, under the provisions of the trust deed, to Frederick Bernard de Steiger (Finsbury Technical College), an ex-member of the Australian Imperial Force.

The Council has been asked by the Coopers' Hill War Memorial Fund Committee and has undertaken to award, in rotation with other bodies, a sum of £25 in prizes to young professional men in commemoration of the Royal Indian Engineering College, Coopers' Hill, and of its members who fell during the war. The Council of the Institution of Civil Engineers is trustee of the fund, the interest on which is expected to yield about £50 a year. Half of this will be awarded annually by the Institution of Civil Engineers. The other half is to be awarded by the I.E.E. in rotation with the Military School of Engineering, Chatham, and the School of Forestry, Oxford.

The Council expresses thanks to the Council of the Institution of Civil Engineers for placing the library and reading rooms of that institution at the disposal of members, which arrangement will be continued until the Institution library has been redecorated and the books returned from storage and replaced on the shelves. It is hoped that this work will be completed by the summer. The Council proposes as an experiment when the library again becomes available, to keep it open during the evenings if the use so made of it justifies the expense. During the year, 163 books and pamphlets have been presented to the reference library by members and others. During the year, 818 books were issued to 408 borrowers, the corresponding numbers in the previous year being 667 and 300 respectively.

The work of the Electrical Appointments Board during the past year has been much restricted owing to the very limited number of vacancies reported to the Board. The Council hopes that firms with vacancies on their staffs will assist the Board by reporting these vacancies to the secretary of the Board at the Institution offices. There are 51 members on the register of the Board at the present time desirous of obtaining employment.

The cost of printing and publishing the *Journal* (including the supplement) in 1920, after allowing for sales, was £6,739, as compared with £3,396 in 1919. The Council is to publish in future in the *Journal* a classified index of British manufacturers engaged in the electrical and allied industries.

Regarding the comprehensive revision of the wiring rules, the Main Committee and its six sub-committees have been actively at work during the session. Each of the technical sub-committees has reported, some of them several times, and the Editing Sub-committee has nearly completed the first draft of the new rules. It is intended, after the draft has been considered and approved by the Main Committee, to forward it to the fire offices and to hold a conference with their representatives. After any necessary modifications have been made, an opportunity will be afforded for discussing the draft in London and at the territorial centres before the rules are published. The British Engineering Standards Association has been asked to draw up standard specifications for wiring accessories which, while not being definitely made compulsory, will embody the requirements of the rules.

The Ship Electrical Equipment Regulations have, with certain omissions, been adopted by Lloyd's Registry of Shipping, and are now in force for all ships built under their survey throughout the world. The sub-committee has on two occasions met representatives from the Electrical Trades Union to discuss the question of urging the Board of Trade to hold examinations and grant certificates to sea-going electricians. The Board of Trade has been approached and, though its first reply was not favourable to the proposal, the matter is still under consideration by the Committee.

The Regulations Sub-committee of the Power Lines Committee was originally appointed to prepare a digest of the Board of Trade regulations and similar matters concerning overhead lines. The Council subsequently referred to the sub-committee the results of the work of the Factors of Safety Sub-committee of the same committee for incorporation and, in addition, it has been charged with the work of suggesting amendments to the various Board of Trade regulations, (*a*) for securing the safety of the public, and (*b*) for ensuring a proper and sufficient supply of electrical energy, which regulations embody those governing overhead lines, earthing, &c., and it is expected that a report will be presented before the commencement of the next session.

Regarding the provisions of a new Electricity Supply Bill introduced in Parliament on April 12th, 1921, the Council has constituted a conference of representatives of the interested bodies which will be summoned to meet at the appropriate time.

In June last the then president (Mr. Roger T. Smith) attended a conference of presidents of technical institutions to discuss proposals put forward by the Civil Service National Whitley Council urging the recruitment and training of non-technical civil servants for technical appointments in the civil service. As a result a letter signed by the president, jointly with the presidents of the Institution of Civil Engineers and other societies, was addressed to the Prime Minister deprecating the proposals.

In November, 1920, the Council addressed a letter to the Burnham Committee of the Board of Education urging that, should it be decided by that committee to differentiate between technical teachers holding first-class honours degrees and those without such degrees, corporate membership of the Institution should be accepted as an equivalent of a first-class honours degree, which in the case of secondary teachers makes them eligible for a higher scale of salaries. The Council's recommendation is under consideration by the committee. Throughout the session under review, the Council has been closely associated, through the president, with the efforts made to secure the continuance of the work of the Finsbury Technical College, which the City and Guilds of London had expressed their intention to close in July, 1921. In consequence of the granting of a temporary annual subsidy from the London County Council and the Board of Education, it has been decided to continue the college for the next five years.

The War Office has decided that the passing of the A.M.I.E.E. examination is to be a qualification for additional pay for officers of the Royal Engineers, Royal Army Service Corps, Royal Corps of Signals, and the Tank Corps (technical). At the request of the War Office, arrangements were made in December last for eleven officers of the Royal Corps of Signals to sit for the A.M.I.E.E. examination in the subject of "military signalling (electrical)."

Considerable progress has been made during the past year in industrial standardisation in electrical matters, and nine British standard specifications have been issued.

The B.E.S.A. has undertaken the co-ordination of the Government department specifications for electrical apparatus and materials, in collaboration with the permanent Government Inter-departmental Committee set up for the purpose. Wherever possible existing British standards will be employed, and when the specifications so prepared are suitable they will be issued as British standards. The work will be carried out as far as possible by the existing committees of the Association. A recommendation of the Wiring Rules Committee that the standardisation of the dimensions of distribution boards and other accessories should be proceeded with has been adopted. The Institution has three representatives on the Main Committee of the Association and five on its Electrical Sectional Committee.

At the time when efforts were being made to establish the British Electrical and Allied Industries Research Association, the Institution and the B.E.A.M.A. each guaranteed £750 per annum for three years towards the expenses, and the Institution paid a first instalment of £375 under its guarantee. The Council has been informed by the Association that in view of the greater funds now at its disposal, funds contributed in equal parts by the electrical industry and the Research Department, the Institution has been released by the Association from its liabilities in this respect. At present, membership of the Association is confined to manufacturers, but provision is made for enrolling other interested persons as associate members, and applications will shortly be invited.

Representatives of the bodies mentioned below have been nominated to form a Standing Joint Committee of Electricity Supply Associations on Coal, constituted under the auspices of the Institution to deal with matters regarding coal as far as relates to electricity supply undertakings, both company and municipal:—The Incorporated Municipal Electrical Association; the Associated Municipal Electrical Engineers of Greater London; the Incorporated Association of Electric Power Companies; the Conference of Chief Officials of the London Electric Supply Companies, and the Provincial Electric Supply Committee of the United Kingdom. In addition, the president of the Institution is *ex officio* a member of the committee, and its honorary secretary is the secretary of the Institution.

The Institution of Engineers (India), to the formation of which the Council gave its cordial support, was formally inaugurated at Calcutta by His Excellency the Viceroy of India, Lord Chelmsford, on February 23rd last. Among the members of the Institution who were present at the meeting were Sir T. O. Callender, Mr. A. C. Coubrough, Mr. E. M. Hughman, and Mr. J. W. Meares.

The Committee of Management of the Benevolent Fund of the Institution reports that on December 31st, 1920, the capital account of the fund stood at £5,709, and the accumulated income at £2,533. The donations and subscriptions to the fund in 1920 amounted to £821. In the course of the year 32 grants were made to eleven persons amounting to a total of £341.

The annual accounts of the I.E.E. for the year 1920 show that after making provision for contingencies as in the previous year, there is a margin to the good on the revenue account for 1920 of £673. This amount, which has been carried to the credit of the general fund, compares with £1,495 in 1919, a decrease of £822. In the accounts for 1919 mortgages stood at £30,198; they now stand at £29,285.

The total of the Life Compositions Fund on January 1st, 1920, was £5,414, and a further amount was received in payment of life compositions during the year, making a total of £5,729. Out of this £52 has been transferred to the general fund, in accordance with the articles of association, on account of life compositions of members deceased during the year, leaving to the credit of the fund £5,677.

The assets amount to £109,673, against liabilities of £6,977, leaving a surplus of £102,696, which, in comparison with that of the year 1919, shows an improvement of £4,906.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Cardboard Slide Rules.

In these days of high prices, devices which make for economy are more than ever welcome, and we are pleased to find that a British firm has taken up and perfected the manufacture of slide-rules of compressed cardboard, formerly a German industry. The Cavendish Press, of Cheam, Surrey, the firm in question, has brought to our notice the "Cavendish helical spring slide-rule," which has been designed by Mr. V. B. Harley-Mason, A.M.Inst.C.E., to reduce the calculation of helical springs—a troublesome process by the usual methods—to a matter of a few seconds. One setting of this slide-rule gives a complete selection of coil diameters and thicknesses of wire, round or square, in 32nds and in S.W.G., without reference to tables of any kind; similarly a single setting gives the number of convolutions for any required deflection per inch, and a third setting enables allowance to be made for any modulus of elasticity. It is claimed that the rule furnishes the most complete information on helical springs ever published, and in the most useful and compact form; and all the working instructions are given on the back of the rule, together with the formulæ on which the scales are based.

The rule is of substantial construction, and is faced with celluloid, which protects the scales from abrasion and dirt; the cursor is made of a single piece of celluloid. We have made trial calculations which fully bear out the claim made for facility of working. We understand that the firm is prepared to make rules to specification for any special purpose.

Incidentally, we may remark that cardboard slide-rules of standard pattern are on the market, and can be obtained from Messrs. Halden & Co., Ltd. They form excellent substitutes for the more expensive rules.

A Portable Electro-Hydraulic Crane.

Messrs. J. W. Flower & Co., of Wimborne, have sent us particulars of their "Eclipse" portable crane (fig. 1). This is mounted on a cast-iron carriage with swivelled wheels or castors which are mounted on ball bearings to provide easy movement. On this carriage a cast-iron pillar is erected inside which is fitted a hydraulic cylinder free to revolve on a ball bearing. Three double action pumps are mounted inside the base of the pillar, and these are driven through machine-cut worm gearing by an electric motor. The pumps send oil from a reservoir through a control valve operated by a handle.

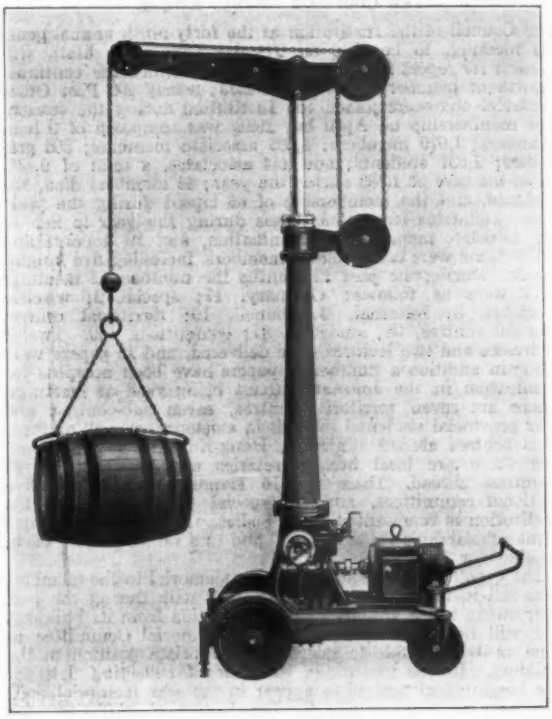

Fig. 1.—Portable Electro-Hydraulic Crane.

The position of this handle decides whether all, part, or none of the pumped oil goes to the hydraulic cylinder. Oil entering the cylinder forces up the ram and jib, and raises the load. To lower, the oil is allowed to return to the reservoir. The dimensions of this crane are as follows: Length of jib, 3.5 ft.; height of ram lowered, 9.5 ft.; height of ram raised to full extent, 13.5 ft.; lift of chain hook, 12 ft. The crane can be made to lift 7, 10 or 20 cwt.

The lifting and lowering rate can be varied between an almost imperceptible motion and a speed of 50 ft. per minute. Overpumping and overloading of the motor is prevented by automatic relief valves.

A New Wiring Connector.

The N.V. Electriciteits Maatschappij Electrostoom, of Rotterdam, refer to a wiring connector recently described in this column (April 15th, 1921, p. 477), and draw our attention to what they claim to be a cheaper connection designed on similar lines which they have recently placed upon the Dutch market. This consists of a red fibre insulating cup, the bottom of which is solid with a bushed "blind" hole. In this hole a spring is fixed. In jointing, the ends of the wires are twisted together (and they have to be twisted very carefully), and are then screwed into the spring which cuts a thread on them and retains them in position. The cup is only ¼ in. in diameter and ⅜ in. long, and so there is ample room for three or four of them in an average sized connector box.

LEGAL.

The "Paragon" Patents.

On May 4th, at the Patent Office, the Comptroller-General heard two cases of opposition to the grant of letters patent in connection with the electrical propulsion of ships, locomotives, &c. The first was in respect of an application by Messrs. Brown, Boveri & Co. for the use of a self-starting synchronous three-phase motor with power-factor correction, and the second was in respect of an application by the Oerlikon Co. in connection with the control switchgear for ships and locomotives. Capt. W. P. Durtnall, who opposed the applications, conducted his case in person. In both cases the Comptroller-General reserved his decision.

Keeling & Walker, Ltd., v. Sturtevant Engineering Co., Ltd.

The Court of Appeal recently had before it an appeal by the plaintiffs from an order of a Divisional Court and a decision of an Official Referee who disallowed their claim against the Sturtevant Co. for the alleged failure of a zinc-oxide recovery plant supplied by them. The defendants agreed to supply and erect the plant for £2,725. Plaintiffs alleged when the matter was before the Court, about six months ago, that the plant wholly failed to collect oxide at the promised rate of 250 lb. of fume per hour, and they claimed £8,525 damages. Defendants contended that the claim was barred by the terms of the contract, providing for goods to be returned if not satisfactory.

The appeal was argued before Lords Justices Bankes, Scrutton and Warrington, and judgment was entered for the Sturtevant Co. with the costs of all hearings.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Thermostatic Switches.

At the present time there appears to be a demand for an inexpensive and practical thermostatic switch capable of dealing with from 10 to 20 amperes, and made to operate automatically on and off between ordinary ranges of room temperatures.

I should esteem it very much if any firms manufacturing apparatus of this class would communicate with me.

British Electrical Development Association (Inc.),
J. W. Beauchamp,
Director and Secretary.

London, W.C. 2.
May 20th, 1921.

The Maintenance of Intercommunication Telephones.

With reference to the letter subscribed by the B.E. Co., published on page 635 of your issue dated 13th inst., under the above heading, we beg to point out to your correspondent that we have built up a large connection on trade telephone work.

We, however, do not advertise this branch of our work, owing to the fact that we represent the contractor on his job, and our men are his men while so engaged. Our view of the matter is that no person undertaking trade work should advertise the fact as your correspondent has done.

Surprised.

May 17th, 1921.

Fire Prevention and the Insurance Companies.

I have read with very much interest the article which appeared in your issue of April 15th, and your editorial comments, because there is much to be said, in my opinion, for the views taken by your correspondent.

The very fact that the great majority of insurance companies have combined to form a tariff in protection of their interests certainly gives such companies a bias not to take cognizance of improved fire-prevention appliances until they have been proved over a long period of time to be thoroughly efficacious, and it is only reasonable that the tariff offices should not move until pressed to do so by competition of other insurance companies, by the energy of the makers of such appliances, or by the pressure of public opinion. It must be remembered in this connection that all fire-prevention devices tend to reduce the income of insurance companies. For this very reason, active competition with non-tariff companies (which can take an independent view and can give expression to their opinion without being hampered by the views of more conservative companies) is of distinct benefit to the insuring public. It is true that there have been many absorptions of non-tariff companies during recent years, but we think your correspondent is not correct when he says that the tariff companies have to-day obtained a practical monopoly in insurance matters. There are several strong and vigorous independent companies, with ample resources, outside the tariff ring, which can deal with the largest risks.

With regard to the statistics which are mentioned, of the amount of property protected by automatic fire alarms, and the loss ratio for the last ten years, if these are reliable (and I am not doubting the fact) then the matter calls for very serious reconsideration.

Speaking for this company, I can say that we shall certainly take steps to get into touch with the actual facts as mentioned, and we are prepared to consider, immediately, special terms for premises so protected. I do not think that insurance companies, as a whole, need fear the result of any investigation by the Royal Commission which has been appointed to inquire into the existing provisions for the avoidance of loss by fire.

Having regard to the enormous liabilities which are carried, the margin of profits shown in the accounts of the companies proves that moderate premiums are, on the whole, charged, but the difficulty which those firms who take the keenest interest in fire prevention have to face is that their specially good risks are not always recognised by adequate reductions in premiums on account of the tariff regulations above referred to.

It is surely in the hands of the traders themselves to see that competition has full play.

In short, the trader has only himself to blame if he does not take advantage of the independent advice and consideration which only a non-tariff office can give.

The English Insurance Co., Ltd.,
Percival J. Alexander,
London, E.C. 2. *Managing Director.*
May 20th, 1921.

[Our correspondent remarks that "all fire-prevention devices tend to reduce the income of insurance companies"; they tend, to a still greater degree, to reduce the *outgoings* of the companies—hence the special terms that can be offered to properly protected risks.—Eds. Elec. Rev.]

The Grading of Mains Engineers.

I do not propose to make any attempt to justify my position as a mains engineer to please two disgruntled charge engineers, but I should like to make one or two comments.

First, with regard to those elusive B.th.u.'s. Unless the ignorance of "P. S." is abysmal, he must realise that it would be of no avail to obtain the highest possible efficiency in the station if the units generated were allowed to run to waste unchecked, through the numerous channels that there are in every mains system. The losses in the mains are not all leakage-to-earth losses, as some seem to imagine.

Secondly, I would tell a true story: A charge engineer, and a very good one at that, was offered the position of mains superintendent on the undertaking at which he was employed. He was willing to accept on one condition, and this condition in his own language was as follows: "Supposing I make a b . . . s of the job, shall I be able afterwards to go back to my old job?" He was informed that that could not be promised as someone else would be appointed in his place; and, easy and simple as is a job as mains superintendent, that charge engineer would not take his chance, and to-day is still on shift.

Thirdly, and most important of all, what brilliant reasoning leads either "N. B." or "P. S." to think that the ideal method of airing their grievance, if they have one, is to write to you, who, beyond backing the E.P.E.A. handsomely in their efforts to obtain an adequate remuneration, have no interest whatever in the salaries schedule?

If these men are E.P.E.A. members, it is about time that they learnt that the only way to obtain redress is through the Association itself, and if they are not satisfied with their present representatives on the N.E.C., or their present section or divisional officers, why, in the name of goodness, do they not themselves do a little of the work or elect others who will suit their requirements?

Merely a Mains Engineer.

May 23rd, 1921.

My colleagues and I, all charge engineers and members of the E.P.E.A., have read the letter of "P. S." with the greatest satisfaction, but up to now have not followed up the matter, hoping that more able and fluent pens than ours would receive a "brain wave."

Now that charge engineers are learning to what extent the "mains," heads of departments, and lesser "fry" have gained under the schedule, they are beginning to realise how badly they have been sold. When one considers that charge engineers comprise from 30 to 40 per cent. of the E.P.E.A. membership, it is easy to see why the official body of that organisation has now got the "wind" so badly over the "grading" question.

Without the charge engineers, nine out of ten stations cannot be run, and without the support of the "charge men" the "mains," heads of departments, &c., cannot hold what they have obtained in such bad faith. Hence their now frantic efforts on the re-grading question, with the know-

ledge that the E.T.U. are proposing a special section and programme for that body of men. The quaint fact of it is, the E.T.U. have already got in the thin end of the wedge with the sub-station men, and many charge engineers are already scenting the finer fruit offered in that quarter, and a quarter, too, be it remembered, where it is not *infra dig.* to accept payment for work done, as at present under the sickness clause charge engineers, as a body, can have no sympathy with the putrid sentiment of "Professionalism"—they have been starved too long, and are still "that bottom dog." They can still afford to leave such beautiful ideals to the I.E.E., with the comfortable knowledge that it is no disgrace to be paid for honest work.

While on the subject of the schedule, we should like to give some instances brought to our knowledge of the way in which this has been interpreted and "operated" upon. First, the six-day week has been seized upon to provide a petty form of promotion for the "pets." The regular men certainly get relief, but on what days?—none on night shift, only on evenings and days, in order to provide a soft job for the "pet." And so the poor charge engineer has to work a seven-day night shift once in three weeks, instead of a six-day shift once a month.

Secondly, the holidays. Men are asked to take their holiday at any odd time between May and October inclusive. May we ask all chiefs who may happen to read this to look up the National Joint Council's definite statement for shift workers?

When more prosperous days arrive, we engineers have made up our minds to quit this mess of pottage.

In conclusion, we are tempted to ask what becomes, eventually, of 99 out of every 100 charge engineers; are they found a job in the office to fill their declining years, or is an outsider put there, and the poor forsaken charge engineer—sacked?

Three Charge Engineers.

May 23rd, 1921.

I am in entire agreement with the remarks of your correspondent "P. S." in the current issue of the REVIEW.

The charge engineer is by no means the bottom dog in the electricity supply industry, and by the grade he is allocated it is evident that he was not represented when the E.P.E.A. salary schedule was drawn up.

In stations up to Class F and G, what are the positions from Grade 3 to Grade 8? I am sure a good number of engineers would be interested to know what these four grades are, and what they are designated.

The shift man seems to have been entirely forgotten by the Schedule Sub-committee. He is not the fortunate individual to be continually under the observation of the chief engineer, but has to rely on himself in all cases of trouble, and it is when trouble occurs that the chief or his assistant realises that the undertaking has been running— evenings, nights, and during week-ends, under the supervision of the charge engineer, and possibly a little more trouble during these times would bring the shift engineer more to their notice, and his grading more into ratio with his arduous duties and responsibilities, and gain for him a little more appreciation.

I have no desire to belittle the responsibilities of the mains engineers, as I feel sure that the majority of them agree that the grading of the charge engineer is a disgrace to our association and the profession.

As an after-thought, and a loophole for wangling, more grades have been introduced into the schedule, but again the same indifference is shown to the shift worker, as Grade 8a and 8b might very well have been over and above Grade 8.

Had the schedule been submitted to the members before acceptance, I think that shift engineers would have had more to say regarding their grading, and although we are promised great changes, I think it time the grading of the charge engineer should be altered, to at least G. 4, and the A, B, C business entirely abolished.

Unity.

May 23rd, 1921.

Cables for Hot Situations.

Your contributor "Two-Phase" recommends C.T.S. cables for hot situations; while this type may be more suitable than V.I.R. in conduit, please note that we do not consider it so satisfactory as lead-covered cables to withstand heat.

While we have never heard of any trouble arising from C.T.S. in hot situations, we know that the sheathing, however suitable for other conditions, will sooner or later be affected by a high degree of heat continuously applied, and we think it only right to give this fact equal publicity to the recommendation made of it.

St. Helens Cable & Rubber Co., Ltd.,
J. H. C. BROOKING,
General Manager.

Warrington.
May 21st, 1921.

Conservative Methods.

I was very interested in reading "Twice Shy's" criticism of conservative methods of packing, whereby fragile goods are packed in cases which must be almost smashed open before the goods can be released.

With the very bad handling which goods are now receiving *en route* by rail and steamer, firm and adequate packing is more than ever necessary, but this should also focus more attention on the method employed. Every removable batten, pad, and wedge requiring pinning in position, should be screwed and not nailed, and, when empties are returnable, the case lids should also be screwed—with stout screws having plenty of grip. An important though fairly obvious point to be remembered is that wherever possible all the removable screws in a case should be of one size.

As regards returnable cases, there is another side to the question, and it is this: The consignee should, on receipt of a screwed case, recognise that it indicates a more expensive mode of packing, and treat it accordingly. "Twice Shy" evidently would do so; Mr. "Work Shy" would not, and does not. I have carefully designed such cases for many years for our consignments of recording instruments, thermometers, &c., but when the cases have been inspected on return from their first journey, they have often been found to have been opened and closed again very roughly. The lids, naturally not a universal fit, but carefully marked with the "way round," have often been replaced another way and the halting screws driven in with a hammer.

There is certainly room for a great improvement in casing goods. One can see how seldom screwed cases are used when one orders some from his packing-case makers, and notes their surprise, and the poor job usually made of the screwing. Packing-case makers do not employ a cabinet-maker, but apparently they could employ, say, one carpenter to great advantage.

Walker, Crosweller & Co.
W. CROSWELLER.

London.
May 23rd, 1921.

A Peculiar Phenomenon.

In reply to "H. E.," the following remarks may assist him in finding the reason of the different luminous effects in his X-ray tubes.

The X-rays, it must be understood, play little or no part in the fluorescence of the glass. This fluorescence is produced by reflected cathode rays which proceed from the anticathode and produce a luminous hemisphere in the glass.

These cathode rays or electrons are due to ionisation of the gases within the tube, and are the means of our getting the X-rays. They are affected by electric and magnetic fields, and "H. E." will observe that on bringing a magnet near an excited X-ray tube the luminous effects on the glass will move as the magnet's position is changed or poles reversed. (The magnet should be suitably constructed.)

The difference in colour is caused by small quantities of different chemical substances in the glass.

Apple-green fluorescence is very common in X-ray bulbs, being due to the presence of manganese, and makers often add a small amount of manganese dioxide so as to yield this colour.

The bluish fluorescence is characteristic of bad and lithium glasses, whilst yellow-green indicates that soda glass has been used.

In marked contrast to the ordinary X-ray tube is the Coolidge tube, in which the vacuum is 1,000 times or so higher than that found in gas tubes, the discharge being conducted by electrons given off from the hot tungsten filament, and not by ionisation of the air left in the tube; the glass walls do not show fluorescence except perhaps a slight illumination in the anode neck or a minute chip in the glass gives rise to a momentary flash as also will a small evolution of tungsten vapour.

This absence of illumination is due to the formation of a negative layer on the inside of the tube, thus preventing the glass from acting as a target to the cathode rays.

C. R. Chadfield.

Melton Mowbray.
May 14th, 1921.

Architects versus Electrical Engineers.

In view of the forthcoming discussion at the I.E.E. on May 31st next, would it not be opportune to raise the question of nomenclature?

For instance, anyone gifted with a certain amount of gumption recognises the architect as a person who is acting in a professional capacity, and therefore is neither commercial nor contracting, being entirely distinct from the builder, both in actual title and functions.

Turn up Whittaker's, and you find the architect's figures under "Professional Fees." Now look for the fees of a kindred profession, consulting electrical engineers. Apparently a non-entity. Perhaps the granting of a Royal Charter may remedy this omission.

Sad to relate, although we find that surveyors, architects, and others can glean such information from their professional handbooks, the well-known "Electrician Blue Book" gives no information, so far as I can gather.

But stay, the Blue Book is a *Trades* directory, and although it gives two lists—consulting electricians and consulting electrical engineers (the necessity for these two different titles I fail to understand by the way)—it may be contended that it is strictly for the use of the trades and not the profession.

Think of the variety of titles. Besides the last two mentioned we have illuminating, constructional, contracting, installation, and, plain, electrical engineers.

There is no clean cut as in the case of Architect *v.* Builder. And now we are faced with, probably, Chartered Electrical Engineer!

One wonders whether the Institution of Electrical Engineers will attempt to remedy the state of affairs in the first place by approaching the Royal Institution of British Architects, under the plea of professional etiquette, to bind its members to the practice of seeking the advice and guidance of those who act in a similar professional capacity to them on the electrical side.

A contractor complained to me recently that he was persuaded by an architect to visit a country house as it was a hardly big enough job for a consultant. Consequently the architect received his advice free of charge, and the contractor came away empty-handed!

I mention this because the contractor will equally benefit by some such arrangement with the R.I.B.A. as will keep each individual in his proper sphere of action.

The architect's clients would immediately benefit by the results of competition alone.

They would realise that they had obtained the best, the most efficient equipment, at the lowest possible price. Result: Satisfaction all round, and the prestige of both the architect and his professional electrical colleague enhanced.

Consultant? A.M.I.E.E.

May 20th, 1921.

The Training of Kinema Operators.

I have noticed with great interest the correspondence in the Electrical Review on the subject of the training of kinema operators, and was specially struck by the letter of "An Electrician Operator," who deplores the lack of training amongst kinema operators. He further expresses his great regret that there is no practical handbook in print on the subject.

I am glad to say that I have recently purchased a new handbook on the subject of kinema operation, which appears to me to be an excellent work, admirably suited for the instruction of young operators or even to improve the knowledge of men of some years' experience.

This book contains the practical knowledge that is necessary for successful kinema operation.

It deals in a non-mathematical manner with the mechanical and optical properties of the projector and with the motor, dynamos, and electrical instruments or parts comprised in the operation of supplying light to the lantern, and also the mechanical manipulation of the parts of the lantern and films.

The book costs the popular price of 4s. 6d., and can be thoroughly recommended to the trade. It is published by Messrs. E. & F. N. Spon, Haymarket. Author, Mr. Ibbetson.

H. M. K. McPherson.

London.
May 17th, 1921.

Copper Losses in a Three-phase Motor Stator.

I read with much interest Mr. Nash's article on a method of determining the copper losses in a three-phase alternating-current stator. However, it may be of some importance to remark that the copper losses calculated according to this method would not be the same as those which really arise in a three-phase stator. As a matter of fact in 50-cycle machines the copper losses when determined in another way, for instance, by determining the short-circuit losses, would appear to be 15 to 30 per cent. (or even more) higher than those found by Mr. Nash.

The fact has been overlooked that the alternating-current resistance of a winding is not the same as the direct-current resistance of the same winding. This is due to the eddy currents which are energised in the copper by some of the leakage lines of force, and the factor which must be introduced to take into account. This difference is, therefore, different for all machines, and different also according to the load of the machine in this way, that the alternating-current resistance increases when the load decreases.

In testing small three-phase machines, I myself found that this factor could reach a value of 1.4 and even 1.6. In any case, whatever three-phase machine it may be, the copper losses will be at least 15 per cent. higher than those calculated according to Mr. Nash's method, and it might be advisable to multiply the so found amount of losses with a factor of at least 1.15 to obtain a more exact result.

N. A. J. Voorhoeve,
Electrical Engineer of Delft University, Holland.
May 16th, 1921.

Charging for Idle Current.

When writing my letter of the 2nd inst., I was certainly under the impression that the tariff outlined in Prof. Kapp's letter of the 14th ult. was his own, but I note from his letter in reply that the tariff is one instituted by a leading power supply undertaking. Prof. Kapp asks how I would apply the principle of a bonus for leading power factor under the Midland tariff which I advocate. The Midland or two-part tariff, kVA charge plus running charge, involves the use of two separate meters, and if a bonus for power factor is necessary, the following is what I would suggest:—

For recording the unit consumption an ordinary cosine or kilowatt-hour meter would be required.

For ascertaining the kVA demand whether unity, lagging, or leading, a sine meter would be installed to record the component of the load which is 90 degrees out of phase with the voltage, either leading or lagging. This meter would be arranged to run, say, in a forward direction with lagging component, when it would run in a backward direction with leading component. Two trains of gears each fitted with recording mechanism would be fitted and each arranged with a ratchet mechanism so that in the forward direction of rotation the lagging train of gears would operate and the leading train free-wheel and *vice versa*. Each train would be fitted with a Merz demand dial (with time-setting period of, say, 15 minutes) to give a reading in kVA demand. By this means the dial fitted to the train operating in a forward direction would give the resultant average kVA demand lagging, and the train running in the backward direction the resultant kVA demand leading. These two indications of demand would be separate and distinct, so that at any time the maximum demand lagging or leading which occurred during the period could be ascertained. Although the *integrations* as shown on the dials giving kilovoltampere-hours of the reactive and capacity components respectively would give some approximate indication as to the time period when the demand was leading or lagging respectively, I confess that I cannot see how the charge could be equitably adjusted as between lagging and leading. In fact this problem appears to become somewhat complex. Perhaps one of your readers can make some useful suggestion on these lines.

I wish to make it quite clear that in suggesting that a bonus for leading power factor is desirable, I did not wish to convey the impression that all supply companies would welcome such a charge, as in many cases a leading power factor would be very undesirable from the point of view of the supply undertaking. There must, however, be a number of instances where the opposite is the case.

Reverting to the tariff set out in Prof. Kapp's letter of the 14th ult., which differs from the above-mentioned tariff in that it is based on *integrations* only of the cosine and sine meters (and not on kVA demand and units), whilst with this system of charge the policy of bonus for leading power factor may be easily applied, I do not consider it commercially sound, as it would compel the supply authority to prohibit the use of static condensers for the improvement of power factor in other than load hours, and this might be difficult to enforce. In explanation I give the following example (figures are approximate only):—

Taking a demand of 50 kW at 70 per cent. p.f. = 71.5 kVA and eight hours a day steady load for 25 days—

Cosine meter records 10,000 units.

Sine meter records 10,200 apparent units.

Now if a static condenser of 17 kVA be connected to the circuit permanently, *i.e.*, 24 hours a day, it will take 17×24 (hours)×25 (days) = 10,200 apparent units at zero p.f. leading, which, as will be seen, exactly neutralises the lagging apparent units as given above, with the result that the sine meter would read zero, and the consumer would be assumed to have run the whole time at unity power factor. Actually during the load period the power factor with the condenser in circuit would have been raised from 70 per cent. to 82.5 per cent. only, *i.e.*, the demand would be 60.5 kVA and not 50 kVA, as would be assumed by the supply authority charging under such a tariff. It is for this reason that I consider the tariff commercially unsound.

Referring to Mr. J. D. Watson's letter of May 8th, could he give one or two practical examples (actual results preferred) showing how his method is applied and justified? Personally, I cannot agree with the principle that the running or unit charge should vary with the power factor, as for all practical purposes the only additional extra running costs due to low power factor are those represented by a small percentage increase in losses.

I maintain that a multi-tariff based on kVA demand and running charge per unit consumed is the only just and commercially sound basis to work upon, and this is the tariff which is being increasingly adopted by the leading supply undertakings.

E. W. Dorey.

London.
May 23rd, 1921.

Direction of Rotation of a.c. Motor.—"Inquirer" desires to thank Mr. S. S. Pilgram for the answer to his query.

Coal Supplies.—Priority List.—The Government has arranged to import coal to meet the essential needs of the country. Arrangements have been made through four firms which are acting as Government agents, and have been given instructions that they are to dispose of the coal only to consumers in accordance with a priority list, which places them in four main groups—namely:—(1) Railways; (2) public utility works, including electricity works; (3) domestic and household purposes; and (4) food producing and preserving concerns.

BUSINESS NOTES.

Bankruptcy Proceedings. — P. DOWNIE, electrical engineer and factor, 355A, Westborough Road, and 88, Ronald Park Avenue, Southend-on-Sea. Receiving order made May 18th, on creditor's petition.

H. E. CARR, electrical contractor, Carlisle Street, Goole.—Receiving order made May 13th, on debtor's own petition. First meeting, May 27th, at the Station Hotel, Goole; public examination, July 7th, at the Court House, Wakefield.

W. A. DAVIS, electrical engineer, late of 3, Coronation Street, Farnley, Leeds.—First meeting, June 2nd; public examination, June 21st; both at Leeds.

ALFRED JOHN HARRISON, electrical and gas engineer, trading as the Xtra Lighting Co., 4, 5 and 6, Old Market, Sunderland, Durham.—The public examination of this debtor was held recently at the Court House, John Street, Sunderland. According to the statement of affairs, the gross liabilities amounted to £423, of which £381 was expected to rank for dividend, and there were no assets. Debtor attributed his failure to slackness of trade, heavy living expenses, and cost of putting his property in order. The examination was adjourned.

Company Liquidations.—AMPERE ELECTRICAL ENGINEERING AND PLATING CO., LTD., South Shields.—The creditors interested herein were called together recently at the offices of Messrs. Hannay & Hannay, solicitors, Bank Chambers, Fowler Street, South Shields. The company had previously gone into voluntary liquidation. According to the statement of affairs presented by the liquidator, the liabilities amounted to £1,828, of which £1 227 was due to the trade, while the bank were scheduled for £501. The balance of £1C0 was in respect of other claims which had not yet been admitted. After allowing £4 for preferential claims, the assets were estimated to realise £586, or a deficiency of £1,242. It was reported that the company was formed in November, 1919, with a nominal capital of £3,000. The issued capital was £1,300, which was fully paid. The loss on the profit and loss account for the three accounting periods totalled £1,511. It was pointed out that being a comparatively new concern, the company had to purchase its initial stock and equipment at the highest prices. As a result it was now suffering owing to the exceptional conditions of the market. The bank had been guaranteed by the directors. A resolution was passed confirming the voluntary liquidation of the company, with Mr. Hammond as the liquidator, and it was suggested that he should realise the estate either by private treaty or public auction.

AMALGAMATED ELECTRICAL WORKS, LTD.—Winding up voluntarily; liquidator, Mr. J. L. Mahon, Windsor House, Kingsway, W.C. Meeting of creditors called for May 31st, at Winchester House, E.C.; particulars of claims, &c., should be sent to the liquidator by June 18th.

R. B. HAND & CO., LTD.—Meeting of creditors June 2nd, at 175, Lavender Hill, London, S.W. 11. Liquidator, Mr. P. J. Hooper.

GRONDAL KJELLIN CO. (1917), LTD.—Meeting of creditors June 1st, at 20, Abchurch Lane, E.C. Particulars of debts, &c., to be sent to the liquidator, Mr. F. W. Paddon, by June 18th.

Dissolution of Partnership.—ALLPORT & DAVIES, motor, electrical, and agricultural engineers, Underhill Street, Bridgnorth. Messrs. J. H. Allport and H. Davies have dissolved partnership.

Trade Announcements.—MESSRS. MAURICE & COWARD, of 139, Oxford Street, W. 1, have been appointed sole selling agents for Messrs. Townshends, Ltd., heating and cooking appliance manufacturers, Ernest Street, Birmingham, and have an extensive range of samples on view at their showrooms in London.

THE ELECTRICAL SPECIALITIES CO., LTD., of 21, Woodstock Street, London, W. 1, now have the telephone installed at their London office: "Mayfair 5603." Their London telegraphic address has been changed to "Dunapecos, Wesdo."

MR. LOUIS H. EULER has been appointed joint managing director of the Saxonia Electrical Wire Co., Ltd., Greenwich, manufacturers of flexible wires and cables. Mr. Francis S. Thomas, the founder of the company, still continues chairman and managing director.

THE STERLING TELEPHONE AND ELECTRIC CO., LTD., 210-212, Tottenham Court Road, W. 1, inform us that they have commenced the manufacture of electric lamps and horns for motor cars on mass-production lines.

By arrangement with United Water Softeners, Ltd., Mr. J. J. Lassen has taken over the meter department of that company, and has formed it into a separate concern under the style of the LASSEN METER AND ENGINEERING CO., Holders Hill House, Hendon, London, N.W. 4, which is specialising in the manufacture of the Rheograph water-flow recorder and Lassen patent tipper meter for boiler installations.

MR. T. ACKROYD, electrical engineer and contractor, has opened business at Unicorn Passage, Burslingate, Bradford.

Catalogues and Lists.—MR. ALBERT MORGAN, A.M.I.E.E., 138, Gower Street, W.C. 1.—Two illustrated leaflets dealing respectively with wall cranes and lift and crane controllers.

MESSRS. J. W. FLOWER & CO., Eclipse Works, Wimborne.—Two well-illustrated publications describing "Eclipse" electro-hydraulic portable cranes.

MESSRS. MAURICE & COWARD, 139, Oxford Street, W. 1.—An illustrated and priced catalogue of "Calor" electric cooking and heating appliances, including toasters, kettles, hot-plates, irons, &c., manufactured by Messrs. Townshend's, Ltd., of Birmingham.

MESSRS. SIEMENS BROTHERS & CO., LTD., Caxton House, Westminster, S.W. 1.—A set of four catalogues of artistic production. No. 600 is a volume dealing with primary cells and batteries, dry and fluid. The illustrations are very clear, and the details presented are sufficient to give the reader a correct idea of the article described. Many types and forms of cells are dealt with, including Leclanché with central zincs, agglomerate six-rod type, and "sack" form; Daniell cells of the original pattern, Minotto pattern, Meidinger or "balloon" form, Callaud type, and numerous other designs; and also Bunsen and bichromate cells and accessories and materials for all types. Catalogue No. 531 A deals with Leclanché fluid cells and batteries, and is equally clear as regards illustrations and details. No. 531 B is devoted to various forms of Leclanché cell and dry batteries, and includes cycle and motor-cycle lighting sets. No. 537 is a catalogue of many types of dry cells and batteries, including "inert" cells.

MR. J. W. BARNARD, 4, Great Winchester Street, E.C. 2.—Leaflet advertising accumulators, electromedical appliances, X-ray apparatus, &c., as well as an accumulator repair service.

MESSRS. HERBERT MORRIS, LTD., Loughborough, Leicestershire.—Book 90, a catalogue giving illustrations and prices of worm and spur-gear pulley blocks, electric hoist blocks, triple-gear pulley blocks, travelling trolleys, &c.

MESSRS. RICH & BUNDY, 13, New Road, Ponders End, N.—An illustrated list giving details and prices of "Hot-Spot" electric fires, grill stoves, irons, table stoves, kettles, immersion heaters, &c.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C. 2.—Leaflet F. 2.481, giving illustrations, prices, and a description of the Haydn T. Harrison system of directive street lighting.—Leaflet No. F. 2 451, an illustrated and priced folder of pendants for semi-indirect lighting with gasfilled lamps.

THE RELAY AUTOMATIC TELEPHONE CO., LTD., Marconi House, Strand, W.C. 2.—A well-produced illustrated brochure dealing with the relay automatic telephone system. The description sets out very clearly the simplicity of operation and other advantages of the system.

THE SUN ELECTRICAL CO., LTD., 118 and 120, Charing Cross Road, W.C. 2.—Five illustrated pamphlets dealing with the "A.B.C." electrical "laundress," together with a list of prices of the machine and its accessories.

MESSRS. NEWTON & WRIGHT, LTD., 471-473, Hornsey Road, N. 19.—An illustrated and priced leaflet describing a new radioscopic couch for X-ray treatment and examination.

MEDWAY'S SAFETY LIFT CO., LTD., 1 and 2, Bucklersbury, E.C. 4.—A splendid example of publicity matter illustrating a large number of electric and hydraulic lifts installed for various purposes. The pictures show lifts of excellent workmanship and taste. Controllers are also illustrated and described.

SWEDISH GENERAL ELECTRIC, LTD., 5, Chancery Lane, W.C. 2.—Three illustrated price lists:—No. 41, stock list of d.c. and single-phase motors and d.c. drills; No. 41A, stock list of two- and three-phase motors, single phase commutator motors, transformers, &c.; No. 41F, a leaflet dealing with "Century" electric fans.

MESSRS. T. SHEPHERD & CO., 4, Charles Street, Hatton Garden, E.C. 1.—An illustrated catalogue giving full details and trade prices of Bergmann's d.c. and a.c. motors, ranging from $\frac{1}{75}$ to 93 h.p.

STERLING TELEPHONE AND ELECTRIC CO., LTD., 210-212, Tottenham Court Road, W. 1.—Publication No. 297, describing, with illustrations, ships' navigation light indicators for d.c. circuits. Items, which are priced, include fuseboards and alarm bells. Also Publication No. 300, dealing with "Sterling" electric lamps and horns for motor-cars. Illustrated and priced.

MESSRS. GENT & CO., LTD., Faraday Works, Leicester.—Folder 54, giving illustrated and priced details of "Regent" industrial telephones of various patterns.

TWISS ENGINEERING AND ELECTRIC TRANSMISSION, LTD., 62 and 63, Queen Street, E.C. 4.—List T L 3, illustrating and describing Twiss solderless cable connections.

Catalogues Wanted.—MESSRS. RANSON & SPARK, electrical engineers, &c., Victoria Square, Felling-on-Tyne, desire to receive catalogues.

Lead.—MESSRS. JAMES FORSTER & CO., reporting on May 21st, said:—"The London Metal Exchange has had an active week in all metals, the sentiment being 'bullish,' on the belief that stocks in consumers' hands are low, and that with the end of the miners' strike material will be wanted. In lead this is undoubtedly the case, as for a long time past consumers have bought from hand to mouth."

Plant for Perth.—Quoting a local newspaper report, a correspondent says:—"Mr. J. Lambert, Corporation electrical engineer, Perth, has been the means of saving £10,000 in the purchase of new generating plant by advising the committee to go outside the trade ring for their purchases."

Wages, &c., in Czecho-Slovakia.—Owing to the reduction of hours from 48 to 32 per week and a reduction of wages by 10 per cent., 20,000 workmen in the metallurgical industry struck work on May 20th.—*Reuter's Trade Service* (Prague).

Book Notices.—"*Transactions* and Year-Book" of the University of Toronto Engineering Society. April, 1921. Pp. 176. Published by the Society.—In addition to its being a chronicle of social and athletic events, this publication includes a number of interesting papers dealing with many branches of engineering. Papers on "Switchboards" and "Power Plant Instruments and Meters" are reproduced.

"The *Bulletin* of the Hydro-Electric Power Commission of Ontario." Vol. VIII, No. 1. January-February, 1921.—This number contains a detailed description of the Nipigon development, the first stage of which is nearing completion. It is illustrated by many clear photographs. The "Lincoln" graphic demand meter is described, and notes on "Safety first" are also included.

"The English Electric Journal." Vol. I, No. 6. April, 1921. London: The English Electric Co., Ltd. Price 1s.—This number of the journal deals with the directors' annual report, and includes articles on "Electric Winders," by J. Kirkwood, B.Sc; "The Modern Steam Condenser," by E. R. Briggs, M.Inst.C.E.; and "Electric Locomotives for Industrial Purposes."

"The Mining Electrical Engineer." Vol. I, No. 8, May, 1921. Manchester: Association of Mining Electrical Engineers. Price 1s. net.—The papers reproduced in this issue include:—"Coal Cutting by Machinery," by George Mullin; "The Installation of Electric Plant Underground," by James Keir; "The Characteristics of the Multi-speed Induction Motor," by F. Creedy; and "Modern Steam Condensing Plant," by J. McGhee.

"Power Factor Correction." By A. E. Clayton. Pp. xii + 108, 36 figs. London: Sir I. Pitman & Sons. Price 2s. 6d. net.

"Heat Transmission by Radiation, Conduction and Convection." By R. Royds. Pp. viii + 238, 102 figs., 27 tables, price 21s.; "Heat Transmission in Boilers, Condensers, and Evaporators." By R. Royds. Pp. viii + 302 136 figs., 43 tables; price 21s.; "The Measurement of Steady and Fluctuating Temperatures." By R. Royds. Pp. xii + 162, 82 figs., 4 tables, price 16s. London: Constable & Co., Ltd.

"Science Abstracts, A and B," Vol. XXIV, Part 4. April 30th, No. 280. Price 2s. 6d. each net. London: E. and F. N. Spon, Ltd.

"*Proceedings* of the Physical Society." Vol. XXXIII, Part 8. April 15th. London: Fleetway Press, Ltd. Price 6s. net.

Glasgow Electricians Resume Work.—In accordance with a decision of a mass meeting of the Clyde district members of the Electrical Trades Union, held on May 12th, the men resumed work on May 23rd. The total number of electricians on strike in the Glasgow district was 900. The majority of these, who were employed mainly in the house building trade, had been idle for 11 weeks. The shipbuilding section had been idle for two weeks. Apart from the shipyards, the dispute arose through the Employers' Association giving notice of a reduction of 3d. per hour in wages, which would have made the wages 2s. per hour as from the first week in March.

Postal Rates Raised Again.—The trade of the country is to be saddled with yet one more burden. When will the last increase in business expenses be recorded? The Postmaster-General announced on Tuesday that in order to meet the deficit on the Post Office Services, postal rates will be raised as from Monday, June 13th.

The *Home* postcard rate which used to be ½d., and is now 1d., will become 1½d. Printed papers up to 1 oz. will be advanced from ½d. to 1d., with ½d. for each additional 2 oz. Registered letters will be 3d. in place of 2d.

Foreign postage rises from 2½d. to 3d. for letters, and from 1d. to 1½d. for postcards. Printed papers will be 1d. for every 2 oz., instead of ½d., and commercial papers will be 1d. for 2 oz., instead of ½d., and the minimum will be 3d. Samples will be 2 oz. 1d. (instead of ½d.) with a minimum of 2d.

Letters for the British Empire and U.S.A. will remain at 2d. for the first oz., but 1½d. (instead of 1d.) will be charged for each additional oz.

Manufacturing in Holland.—The report of the Algemeene Nederlandsche Electriciteits Maatschappij (late Groeneveld, Ruempol & Co.), of Amsterdam, states that although the turnover at the beginning of 1920 took an upward course, the company suffered from the general depression and the continued fall in the market, thus rendering it necessary for estimates to be based upon the prices of that day in order to be still able to compete. The value of the turnover amounted to 2,500,000 florins, and the orders on hand at the close of the year reached 1,000,000 florins, which has now increased to 1,400,000 florins. It was necessary to raise a 7 per cent. loan for 600,000 florins in order to provide for the completion of the new factory and warehouse, which were now being brought into use. The sum of 527,000 florins has been written off for depreciation, as against 21,900 florins in 1919, and 516,000 florins of the former applies to stocks on which nothing was written off in the previous year. The final result of the year has been a loss of 1,480 florins, this comparing with a distribution at the rate of 12 per cent. on share capital of 1,500,000 florins in 1919.

New Zealand Customs Tariff.—In February last Sir W. Peter Rylands, on behalf of the 18 000 British manufacturers in the Federation of British Industries, addressed a letter to the Prime Minister of New Zealand, requesting that, in the proposed revision of the Customs Tariff, British goods imported into New Zealand should be accorded a continuance of the preferential treatment at present in operation. The Rt. Hon. W. F. Massey has now replied from Wellington, giving the assurance that, when the new tariff is being framed, the interests of British industries will not be overlooked.

The British Engineers' Association.—The annual general meeting of this Association took place at 32, Victoria Street, London, S.W.1, on Thursday, May 12th. At a meeting of the Council of the Association that followed, Mr. Nevile Gwynne, late chairman of the Executive Committee, was elected President of the Association, in place of the retiring President, Colonel O. C. Armstrong, D.S.O., who had occupied the position of President for three years, and to whom a very hearty vote of thanks was accorded. Mr. E. W. Petter was elected chairman of the Executive Committee in succession to Mr. Nevile Gwynne.

Demand for Power in China.—After approximately nine months of quiescence, signs are not wanting of a revival in the demand for power plant in China. From the middle of 1919 to the summer of 1920, says the *North China Daily News*, a great number of orders for power plant for all purposes were placed—for cotton and flour mills, silk mills, tramways and electric light works. The south of China was not especially active, and the further cities in the west showed few signs of industrial awakening. Changsha was slightly interested in cotton mill machinery, but, generally speaking, the wealthier communities beyond Hankow confined their enterprises to electric and tramway undertakings. In the north, enterprise was very pronounced, for instance, in Tsingtao and especially Tientsin, while Manchuria, particularly Dairen and Harbin, ordered much machinery. In common with other articles of commerce, machinery felt the slump in exchange badly, and consequently it was not surprising to find that orders fell away almost completely during the last six months of 1920. Since then, however, a rather different sentiment has displayed itself, and both in the north and here a distinct inquiry has again been seen for power plant for practically all purposes. More confidence in the future is visible in the north, and seeing the large profits which other industrial concerns are making, the Chinese are prepared to invest larger sums in such undertakings. In the meantime a considerable amount of the power machinery is coming forward, although labour conditions, both in Europe and America, have delayed deliveries to quite a considerable extent. With reference to the machinery ordered during the twelve months between 1919 and 1920, it is highly satisfactory to know that well over 75 per cent. of the boiler plant was of British manufacture. In this line of engineering the United Kingdom has always been pre-eminent, a fact which is fully appreciated by the Chinese, so much so that even to-day in quoting for power requirements, German agents are still looking to Great Britain to a considerable extent for boilers. The contracts for boilers have in some instances been very large. In addition, Great Britain took an ample share in orders for other machinery, and besides cotton and other mills, contracts for tramway and electric light installations have been placed with British firms. —*Reuter's Trade Service* (Shanghai).

The Coal Dispute.—The substitution, or partial substitution of oil burners for coal firing apparatus in power stations proceeds in all parts of the country. Estimates of the cost of substitution show wide variations. For instance, the cost of converting a boiler as an experiment at Aberdeen was recently given as £30. At Dundee the cost of conversion, according to the engineer's estimate, would be from £2,000 to £2,500. The number of boilers is not stated, but upon the same basis as the Aberdeen figure this sum would cover the expenditure upon 80 boilers. The estimated cost of conversion at Swansea is £1,000; the capacity of the Swansea station is about half that of the Dundee undertaking.

A peculiar kind of reserve is being utilised at Bradford. Over £20,000 worth of small coal lay in the filter beds at the Corporation sewage works, where it served as a filtration medium. The quality of this coal was found to be practically unimpaired, and the greater part of the 14,000 tons has now been removed to supply the electricity and gas works.

Despite the "embargo" placed upon the importation of foreign coal by the National Federation of Transport Workers, supplies are coming in at a fairly rapid rate, although the cost has in many cases been increased by delay in off-loading at the ports. Nevertheless, the Federation officials declare themselves satisfied with the results of their restrictions.

The strike at the L.C.C.'s Greenwich station continues, but the substitute labour has kept the London tramways running. Seeing that their action was having little effect the trade unions concerned, induced the United Vehicle Workers' Union to ballot upon the question of withdrawing drivers and conductors from cars kept running by power supplied by means of "blackleg" labour. The result was an emphatic vote against the course suggested.

Further restrictions upon the use of electricity have necessarily been imposed. In Birmingham low-pressure supplies have been cut off between the hours of two and seven p.m., and it is significant, in view of the oft-repeated assertion that this has become a pleasure-loving country, that the onus will fall most heavily upon the proprietors of theatres and kinemas.

The "live" registers of the Employment Exchanges show an ever-increasing growth of unemployment. The *Morning Post* quotes figures showing that during the week ended May 13th, 63,600 persons were added to the total, making it 1,990,700. Persons on reduced wages owing to curtailment of working hours numbered 1,129,400.

Cape Town Contractors.—A deputation representing the Electrical Contractors' Association, the Electrical Trades Union, and the Building Trades recently waited upon the Administrator for the purpose of supporting the proposed Ordinance for the registration of electrical contractors and the licensing of wiremen. The deputation was well received by His Excellency, and informed that the Ordinance was being put forward immediately.

Wire Production in Russia.—Work in connection with the electrification of the Northern railways of Russia has produced a great demand for small gauge wire, the reserves of which are remarkably small in Russia at the moment. In order to increase the supply, the cable factory of Petrograd has been re-equipped and started to work. This factory can produce 270 poods of wire per day.

Summer Sports.—The Social and Athletic Club of Electrical Installations, Ltd., opened their cricket season on Saturday, May 7th, at their grounds at Perivale, Middlesex. They were successful both on that date and on May 14th. Last Saturday, 21st inst., they were playing a match against the General Electric Co., Ltd., Athletic Club.

Oil Fuel.—Messrs. Johnson & Phillips, Ltd., Charlton, S.E. 7, advise us that they have now converted their boiler plant to burn oil instead of coal. They have ample stocks of raw material, and will, therefore, be able to continue full supplies to their customers of all their products (cable switchgear, transformers, instruments, &c.), no matter how long the coal stoppage may last.

Ericsson Losses in Russia.—An Exchange telegraph dispatch from Copenhagen credits the Gothenburg *Handelstidning* with stating that the L. M. Ericsson Co., the Swedish manufacturers of telephone apparatus, is considering the desirability of writing off about 50,000,000 kroner in respect of losses in three associated companies in Russia. The share capital of the Ericsson Co. is 73,260,000 kroner, and it has a reserve of 9,820,000 kroner.

Trade Conditions in Australasia.—Although merchants do not expect an early improvement in turnover, a more cheerful feeling prevails in trading circles. The tone on the Stock Exchange is also brighter. Similar reports are to hand from Sydney. The local metal market is quiet. Goods from overseas are arriving more rapidly than they can be absorbed. Business is quieter in New Zealand, and there is a continuance of heavy importations. The building trade is picking up. Hardware prices have dropped. American plain wire is quoted at £30 per ton, but an improvement in demand is setting in. There are indications that the Japanese trade boom in New Zealand has definitely ended.

The banks are maintaining credit restrictions. Merchants anticipate that business will improve after June. The financial stringency is very real. Reports from Auckland show active trade in necessities with numerous reductions in price.—*Reuter's Trade Service* (Melbourne).

The "Paragon" Super-Diesel Engine. — Captain Wm. P. Durtnall, the inventor of the above new engine, informs us that he has made manufacturing arrangements with one of the largest Diesel engine manufacturers in Europe to make these engines for general industrial purposes. It is stated that this engine is lighter, cheaper, and has a higher thermal efficiency than the ordinary Diesel type; it is of the multi-cylinder type, and has no flywheel. The exhaust temperature and pressure are very much lower, and the engine may be installed in situations where the ordinary engines are barred. The engines will be placed on the British market by the Piggott Electrical Co., Ltd., of 24, New Bridge Street, London, E.C. 4.

E.D.A. Activities.—E.D.A. 160, just issued by the Electrical Development Association, Hampden House, Kingsway, W.C. 2, is a card entitled "Seed Time." This represents the Association as sowing the seed of electrical progress, the results of which will be a rich harvest for industry. It points out that the greater the support given by manufacturers, the greater will be the outcome in the future. Apathy only results in "weeds and tares."

We have also received a publication, "Electricity on the Farm," by Mr. R. Borlase Matthews, A.M.I.C.E., M.I.E.E. (E.D.A. 161). This deals with such questions as cost and efficiency. The number of applications electricity can find in farming is legion; Mr. Matthews gives a long list of them. The concluding remarks answer the questions regarding the way to obtain a supply of electricity—if there is an undertaking operating in the neighbourhood.

Inquiries.—The name and address of the manufacturers of "A.R.A.R." electric lamps (presumably Dutch) are required.

The correct address is required of a firm in London and Birmingham whose initials are O. G. & Co., and who are makers of vibrators, &c.

Copper.—The Wallaroo copper miners have agreed to a temporary reduction of wages, and it is now hoped that the mines will reopen shortly.—*Reuter's Trade Service* (Wallaroo, S.A., May 2nd).

Hungary.—The first calcium carbide factory in Hungary has just been started by the Ungarische Allgemeine Kohlenbergbau Gesellschaft at their power station at Tatabanya in Fellsö Galla. The factory is equipped with a 700-kVA single-phase furnace, to yield 80 wagons of carbide yearly. Three men working 10 hours a day, and four working eight-hour shifts, suffice to man the factory. The output it is estimated will cover one-fourth of Hungary's total consumption of carbide.

International Exhibition at Lima.—In connection with the International Centenary Exhibition to be held at Lima, in July, the Peruvian Government has informed the Consul-General for Peru that manufacturers' goods, including machinery, &c., intended for exhibition purposes will be admitted free of Customs duties and Consular fees.—*Reuter's Trade Service.*

German Exports Indemnity.—Reuter's correspondent in Berlin says it was officially announced that the German Government had decided to indemnify exporters in paper marks for the levy imposed by the Entente States on German exports.

Engineering Wages.—A deputation of representatives of the Amalgamated Engineering Union and the National Federation of Engineering Trades attended at the Ministry of Labour, on May 20th, to state their case for a Court of Inquiry under Part 2 of the Industrial Courts Act into the employers' demand for a reduction of wages, affecting about one million skilled and semi-skilled workmen. The deputation was received by Sir David Shackleton.

China.—A new electric company has recently been established in Shelwei, a salt centre in Yangchow. All departments were to start work on March 20th, 1921.

International Exhibition at Belgrade.—The *Journal* of the Royal Society of Arts states that an international exhibition will be opened at Belgrade in June, under the auspices of the Museum of Industry and Commerce of that city. The Serbian Government has placed at the disposal of the promoters an area of 20,000 sq. metres (about five acres), and the necessary work is in progress.

Swedish Telephone Manufacturing.—The fusion of the L. M. Ericsson Telephone Co. and the H. T. Cedergren Telephone Manufacturing Co. has now been effected. One share in the Cedergren Co. will equal 10 shares in the Ericsson concern, or Kr. 500. The fusion will be reckoned as from January 1st, 1921.—*Reuter's Trade Service* (Stockholm, May 22nd).

Revision of Spanish Customs Tariff.—A totally new scale of Customs duties is in force in Spain from 21st inst. The old regulations have been revised in every tariff, the new ones including considerable increases over those now revoked. Although the new tariffs are already in force, there are excepted from its regulations, with regard to goods from Great Britain and the British Empire, all merchandise with a bill of lading in which it is stated that they left the country of origin before 21st inst., but that document must be *visé* by the Spanish Consuls. Goods which were awaiting release by the Customs Houses on 21st inst., and those in bond which are to be declared for consumption within seven days from the day on which the new Customs duties came into force, are also excepted from the new regulations. It is advisable for every British firm dealing with Spain to consult with the Spanish Chamber of Commerce (40, Trinity Square, E.C. 3), about the amount of the duties, which in some particular cases are lower than in the preceding tariffs.—*Reuter's Trade Service.*

Copper and Lead Prices.—Messrs. F. Smith & Co. report May 24th:—Copper (electrolytic bars), £77, £4 increase; ditto sheets, no change; ditto wire rods, £93, £4 increase; ditto h.c. wire, 11¼d., ⅛d. increase; silicium bronze wire, 1s. 4d., ¼d. increase.

Messrs. James & Shakespeare report May 24th:—Copper bars (best selected), sheet and rod, £116, £2 increase; English pig lead, £25 5s., 5s. increase on last week's quotation.

Coming Reduction in Petrol Prices.—*The Motor* learns on good authority that a considerable reduction in the price of petrol is imminent, owing to the large stocks held in this country. Imports have recently exceeded those of any previous period. The reduction, it is thought, will probably be as much as 1s. per gallon, bringing the price to within the region of 2s. 6d.

Chinese-German Relations.—A treaty putting an end to the state of war and re-establishing diplomatic and commercial relations between China and Germany was signed, says the *Daily Mail*, at Peking on May 20th.

Large Lamp Contract.—The General Electric Co., Ltd., has received a half-yearly contract for the supply of metal, gasfilled, and carbon-filament lamps to H.M. Office of Works. The contract runs into many thousands of lamps.

U.S. Electric Motor Exports.—Exports of electric motors from the United States in 1920 were valued at $13,420,076. In 1919 the total was $10,635,476. Canada was the largest buyer in both years, taking 18 per cent. of the motor exports in 1920, and 15 per cent. in 1919. Japan came second in both years, and England third.—*Reuter's Trade Service* (Washington).

Irish Railways and the Bill.—As Mr. J. W. Hill pointed out at the annual meeting of the Dublin and Lucan Electric Railway Co., the plan adopted for the British railways cannot meet Ireland's needs. It would simply mean that the majority of the Irish lines would be compelled to close down before the end of the year. The circumstances of individual concerns must be considered, and all of them must receive fair treatment. One great danger is that the Government may try to leave the final settlement to the phantom Council of Ireland. Any suggestion to that effect must be resisted strenuously. The final settlement must not be delayed beyond the appointed day.—*Irish Times.*

The Electricians' Wages Dispute.—The outcome of the Blackpool conference of the Electrical Trades Union, referred to in our last issue, was the issue of instructions to the men on strike to resume work at the reduced wages, pending the next meeting between the employers and the E.T.U. Consequently work was resumed on May 23rd, and we are informed that the meeting of the two sides of the industry is to be held on May 31st. As a result of the dispute, we learn that dissensions have arisen within the E.T.U., and that developments of a startling nature are on the way.

English Electric Shield.—Mr. John Sampson, C.B.E., one of the directors of the English Electric Co., Ltd., has offered a shield for annual competition by physical training teams representing the various works of the company. Major the Marquis de Bucy, Director Physical Training, War Office, has consented to act as judge in the competition.

LIGHTING AND POWER NOTES.

Australia.—PERTH.—The accounts of the Government's electricity undertaking for the financial year 1919-20 show a total revenue of £119,656, as compared with £102,774 in the previous year. Working expenses amounted to £74,216 as against £58,652, leaving a gross profit of £45,440 (£44,122). The net result was a profit of £18,093.

Barnsley.—COST OF ELECTRICITY.—In presenting the annual report upon the electricity undertaking, the chairman of the Electricity Committee spoke of protests by consumers against charges twice those prevailing before the war. He reminded the Council that coal was costing about 425 per cent. more, and wages 180 per cent., in addition to the increased cost of money. Having due regard to these facts, he considered it rather to be wondered at that electricity was so cheap. They were enabled to sell at such a price because of improved efficiency by which coal consumption had been halved.

China.—RAILWAY CO. TO INSTALL ELECTRIC PLANT.—The Tientsin-Pukow Railway Co. has decided to install an electric plant at a cost of $900,000 at Pukow.—*Reuter's Trade Service* (Shanghai).

Coleraine.—ELECTRIC LIGHTING SCHEME.—The Urban Council has agreed that the laying of the mains in connection with the public electric lighting scheme should be completed within six months from September next. Messrs Curran Bros., Belfast, the chief contractors, hope to complete the whole of the electrical installation in 10 months unless prevented or delayed by some unforeseen circumstances.

Colwyn Bay.—LOANS.—The Council is applying to the Electricity Commissioners for sanction to borrow £25,000. This will be lent to the North Wales Power Co. to defray the cost of erecting transmission lines to Colwyn Bay from the Dolgarrog station. Sanction is also being sought to the borrowing of £48,348 for the provision of mains, sub-stations, &c.

Continental.—RUSSIA.—The Electricity Bureau of the Soviet Government reports that there are at present in Russia, including what are termed the autonomous territories, 643 electrical stations, of which 246 are in country districts. The scarcity of fuel still presses on present and immediately prospective industry in Russia; so much so that it has been decided to close certain power stations in Petrograd between May 5th and August 15th, solely for the purpose of economising fuel. Advantage, however, will be taken of this enforced idleness to have the stations completely overhauled and put into good running condition.

GREECE.—The water resources of Greece have recently been the subject of a detailed survey by a Swiss engineer, appointed by the Government, with the object of their utilisation for the production of electricity. According to the report presented, the waterfalls of Western Macedonia are capable of yielding 350,000 h.p., equal to a yearly output of 120,000,000 kWh. This energy would suffice for the needs of the cities of Athens, Salonica, the Piræus, and the Larissa railway. The cost of installation is reckoned at 180,000,000 drachmas. The use of water power would free Greece from the need to import coal, and would tend vastly to develop the native industries.

FRANCE.—The central station of the Société de l'Electricité de Valenciennes-Anzin, which was seriously damaged during the war, has been completely reconstructed, and is now in full working order.

Electric steelworks and furnaces, over 100 ft. long, were carried away by a formidable landslide of rocks at Allevard, Isère, recently. The damage reaches several million francs.—*Evening Standard.*

Derby.—CAUSE OF FIRE.—Later reports concerning the fire which broke out at the power station on May 13th (ELECTRICAL REVIEW, May 20th), indicate that it was due to the bursting of an oil-cooled transformer which had been in service for 12 years. Many cables and a switchboard were damaged, and the replacement and repair of these occupied a great deal of time.

Dundee.—OIL FUEL.—At a meeting of the Electricity Committee on May 17th, the question of using oil fuel at the power station was discussed. The engineer said that at present prices, and estimating that 70 tons of oil could do the work of 100 tons of coal, the cost would be respectively £490 and £300 for those quantities. The cost of fitting oil burners would be between £2,000 and £2,500. In the circumstances it was decided not to proceed further, as considerable expense, which would have to be met by higher charges, had already been occasioned by the coal dispute.

Edinburgh.—NEW SUB-STATION.—A new electric sub-station is to be constructed at Causewayside from plans prepared by Sir Alexander B. W. Kennedy.

Electricity District.—MID-LANCASHIRE.—The Electricity Commissioners give notice that the time within which objections and representations may be made, and schemes submitted, in connection with the above named district has again been extended from the last day of this month until July 30th, 1921.

Glasgow.—DALMARNOCK STATION.—On May 11th an additional 18,750 kW Metropolitan-Vickers turbo-generator set was put into operation at the Dalmarnock station. Since the station was started, many economies have been effected in the generation of electricity. In the older stations the average coal consumption per kW-hour generated was 3·42 lb.; at Dalmarnock this figure has been reduced to 1·71 lb. In this way it is estimated that a saving of £62,784 has been made. In addition to the economy in fuel consumption, charges for coal and ash-handling, and wages have been reduced considerably.

At the Port Dundas station oil fuel burners have been installed on one or two boilers, and an extension of the system is being considered.

Grampian Scheme.—POSTPONEMENT.—The Grampian electricity supply scheme is to be held over, the promoters having decided not to proceed with the Bill this year.

Hamilton (N.B.).—EXTENSIONS.—The Electric Lighting Committee is carrying out extensions consisting of new cables and pillars, costing £6,000.

Herne Bay.—REVOCATION OF ORDER.—The Ministry of Transport has revoked the Herne Bay Gas and Electricity Order, 1913. Similar action has been taken with regard to the Mid-Sussex Electric Lighting Order, 1913.

Heywood.—YEAR'S WORKING.—The past year's working of the electricity undertaking of the Corporation has resulted in a profit of £829. In the previous year the profit was £841.

Hull.—EXTENSION OF SUPPLY.—In connection with the arrangement under which the Corporation is to supply electricity to Hessle, the City Electricity Committee has acceded to a request to light those streets in which electric mains are laid, and to charge no more than the current rate for gas.

Ipswich.—LOAN.—After a long discussion at a recent meeting of the Town Council, the Electricity Committee was given permission to apply for sanction to borrow £20,000 for mains extensions, £5,000 for consumers' services, and £5,000 for meters, &c.

Kilmarnock.—EXTENSION OF AREA.—The Corporation is applying to the Electricity Commissioners for permission to extend its area for the supply of electricity. The new area includes the important burghs of Ardrossan, Saltcoats, and Kilwinning.

Leicester.—PROTEST AGAINST RESTRICTIONS.—A correspondent, signing himself "Manufacturer," writes to the *Leicester Mail* protesting against the restrictions which have been imposed upon the use of electricity for power purposes, while gas has been exempted. He says:—"Many progressive manufacturing firms have discarded gas and replaced it by electricity—a cleaner and healthier method of working. Why these firms and their workpeople should be penalised by the change when both gas and electricity are supplied by the same authorities, is a question that at this time many are asking, and one that requires some explanation and readjustment."

Leith.—ELECTRICAL PUMPS FOR DOCK.—The Prince of Wales's Dry Dock will be out of service for the next six or eight weeks, as the steam pumps are being replaced by electric pumps, which are to be operated by power supplied from the Commissioners' own power station. The cost will be approximately £4,000.—*Scotsman.*

London.—ST. PANCRAS.—The chief electrical engineer has recommended the installation of a number of mercury-vapour rectifiers. It is proposed to obtain them from Switzerland, and the engineer and the chairman of the Electricity Committee are to visit Baden for the purpose of inspecting rectifying plant in operation.

BATTERSEA.—The Electricity Committee recommends the provision of an additional 0·5 sq. in. concentric feeder to cope with the increasing supply of electricity to the north-western part of the area. The estimated cost of the cable is £1,126.

HAMMERSMITH.—The Borough Council is recommended to apply for sanction to borrow £2,500 part cost of laying a duplicate main between the Hammersmith and Fulham generating stations under the Battersea-Fulham-Hammersmith linking-up scheme.

STOKE NEWINGTON.—The Electric Lighting Committee reports the receipt of sanction to borrow £9,934 for the extension of mains and services.

Mytholmroyd.—Electricity Supply.—The Council has decided that it cannot at present approve of a draft agreement with the Yorkshire Electric Power Co. for the lighting of public lamps. It was decided to support the application by the Electrical Distribution of Yorkshire, Ltd., for a special order authorising that company to supply electricity within the Mytholmroyd urban area, on the understanding that Caldene Avenue was included in the area of supply; that the charges were reasonable in comparison with other districts; and that supply would be given as early as possible (a verbal assurance of a supply in August having been given).

Newcastle (Staffs.).—Year's Working.—The accounts of the electricity undertaking for the year ended March 31st last show a total income of £20,817, as against £16,810 in the previous year. Working expenses amounted to £15,984, as compared with £11,992, leaving a gross profit of £4,833 (£4,818). After payment of income-tax, interest charges, &c., the net result was a credit balance of £1,365, from which a deficit of £864 brought forward was deducted.

Rathmines (Dublin).—Strike.—The electricity supply remains suspended, owing to a strike of Council employés on a question of working hours.

Reading.—Low-grade Fuel.—The Reading Electric Supply Co., Ltd., has issued a notice to consumers stating that the poor quality of the low-grade refuse coal being supplied may necessitate temporary suspension of supply. In this event consumers are asked to make sure that all switches are immediately switched off.

Salford.—New Generating Set.—On May 9th, the Mayor, members of the Council, and many leading citizens visited the Frederick Road works to inspect the new 5,000 kW turbo-alternator supplied by the Metropolitan-Vickers Electrical Co., Ltd. The Mayor started up the set, and afterwards presided at a dinner at the Town Hall, when Alderman Worsley, in a speech, described the wonderful progress of the electricity department. The new set is designed to run at a speed of 3,000 r.p.m., and gives a three-phase, 50-cycle supply at 6,600 V. The steam consumption varies from 12·75 to 13·92 lb. per kWh, at full and half loads respectively. The rated power of 5,000 kW is given at 0·8 p.f.

South Africa.—Durban.—The accounts of the electricity undertaking for the year ended July 31st, 1920, show a gross profit of £65,399.

Southampton.—Extensions.—At a meeting of the Corporation on May 18th, the Electricity Committee recommended the acceptance of a tender for the construction of boiler foundations, &c., at the electricity works at a cost of £14,570, subject to the sanctioning of a loan of this amount by the Electricity Commissioners. Negotiations are to be entered into with the Eastleigh and Bishopstoke Urban District Council which requires a supply of electricity from Southampton as an alternative to setting up works of its own. The Pirelli-General Cable Co., Ltd., is establishing a factory at Eastleigh.

Swansea.—Oil Fuel.—At a meeting of the Electricity Committee the borough electrical engineer reported at length upon the question of utilising oil fuel at the electricity station in an auxiliary capacity to coal. He was authorised to make inquiries as to the working of similar plant elsewhere.

United States.—Power Company Statistics.—In an interesting article upon the American and Canadian electricity undertakings during 1920, the *Electrical World* gives figures indicating the magnitude and rapid growth of this important industry. A list is given of 80 companies which had outputs exceeding 100 000,000 kWh, and nine of these supplied more than 1,000,000,000 kWh each during the year. The Niagara Falls Power Co. heads the list with an output of 2,328,326,064 kWh, and the next in order is the Commonwealth Edison Co. with 1,883,570,000 kWh. This last company also had the largest simultaneous load—478,820 kW.

TRAMWAY AND RAILWAY NOTES.

Australia.—Brisbane.—In connection with the proposed purchase of the Brisbane tramways by the Government, Mr. J. S. Badger, manager of the Brisbane Tramway Co., recently said that the future of the tramways was very much in the hands of the Government. He denied that the company was holding up the Government for a high price. A figure much less than £3,000,000 had been suggested as a basis of negotiation, but if the parties could not agree about the price there was nothing to prevent the Government going ahead and acquiring the undertaking at once. Negotiations had not been broken off nor had an extension of time been granted the company.—*Daily Telegraph* (Sydney).

Bournemouth.—Year's Working.—The report of the general manager of the Corporation tramways for the year ended March 31st last, shows a total revenue of £196,833, compared with £190,028 in the previous year. Working expenses amounted to £152,044, as against £114,271, leaving a gross profit of £44,789 (£75,757). After crediting bank interest and debiting loan charges (which were heavy on account of the cost of reconstruction) and taxes, the result was a net deficit of £14,868. The number of car-miles run increased from 1,684,874 to 1,837,576, and the number of passengers carried from 27,080,255 to 27,403,523.

Brazil.—Electric Locomotives.—The *Railway Review* states that the first Baldwin-Westinghouse freight locomotive for the Paulista Railway Co., in Brazil, has been completed and tested. The passenger locomotives are now nearing completion. These locomotives are to be used in main line freight service on the Paulista Railway, which is a broad gauge trunk line through the most prosperous and productive part of the State of Sao Paulo. The freight locomotives for the Paulista Railway weigh 105 metric tons, and have six driving axles, each equipped with one 280-h.p. d.c. motor, arranged for operation with two motors in series on the 3,000-V line. They are designed to handle trailing loads up to 700 metric tons over a line having a maximum grade of approximately 2 per cent.

Continental.—France.—The Valenciennes section of the Société des Chemins de Fer Economiques du Nord, which was seriously damaged during the war, has now been repaired, and nearly the whole system is again in working order. The lines cover a distance of about 38 miles, of which 22½ miles have been electrified, while arrangements are in hand for the electrification of the remaining steam-operated portion.

Demerara.—Car Construction.—The Demerara Electric Co., which operates a tramway service in and around Georgetown, is now constructing its own cars in the Colony. Native wood, for which British Guiana is famous, is used for the purpose. Already 16 such cars have either been rebuilt or constructed at the company's works.—*Times Trade Supplement.*

Edinburgh.—Tramway Electrification.—The Tramways Committee has decided that the work of erecting the overhead equipment for the electrification of the tramways is to be done by the Council's own department.

Egypt.—Cairo Strike Riots.—On May 18th, at Shoubrah, a bomb was thrown at a volunteer tramwayman. Nine persons, including three policemen, were injured. The incident was the outcome of the resentment felt by the strikers against the loyal workers and volunteers who are assisting in keeping the public service running.—*Morning Post.*

Falkirk.—Broken Trolley Wire.—An overhead electric wire at Falkirk snapped and fell on the top of a tramcar. One of the passengers, a nurse, was struck across the face and badly burned, and a soldier, in order to get clear of danger, jumped from the top of the car, fracturing an arm and spraining an ankle. With great presence of mind, a miner who was on the car rolled his handkerchief tightly round his hand, and seizing the live wire, threw it over the side of the car.—*Daily Telegraph.*

Glasgow.—Oil Fuel.—The Tramways Committee has authorised the manager to have one of the boilers in Pinkston power station altered as an experiment in connection with the proposed introduction of oil fuel.

Huddersfield.—Year's Working.—The accounts of the tramway undertaking for the year ended March 31st last record a total income of £275,407, as compared with £261 147 in the previous year. Working expenses amounted to £242,033, as against £217,526, leaving a gross surplus of £33,374 (£43,620). Loan interest, taxes, &c., totalled £34,135, making the net result a deficit of £761; last year a net profit of £485 was made.

Leeds.—Restoration of Services.—As a result of the adoption of oil fuel at the generating station, practically the full tramway service has been restored on most routes, and on May 23rd running was resumed—partly in full and partly restricted—on the routes on which services had been entirely suspended.

London.—Oil Fuel at L.C.C. Station.—Replying to a question put to him at a recent meeting of the L.C.C., Mr. Squires, chairman of the Highways Committee, said that hitherto the use of oil fuel at the Council's Greenwich station had not been considered an economic proposition. The coal dispute had altered the perspective, and the installation of oil fuel burners was now receiving careful consideration.

Bank Holiday Record.—In spite of the coal dispute, Whit Monday proved to be a record day for the L.C.C. tramways. It is reported that about 2,000,000 passengers were carried, and fares totalling £19,000 were paid.

Oldham.—Offer of Purchase.—The directors of the Oldham, Ashton, and Hyde Electric Tramways, Ltd., report that an offer to purchase the system for £125,000 has been received, and they recommend acceptance by the shareholders. This has since been agreed to.

Southport.—Accident.—An electric tramcar, which was descending Eastbank Street Bridge, on Whit Monday, ran into a cab, which was overturned. There were three passengers in the latter, two ladies and a gentleman, but, fortunately, no one was hurt.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—Telephone Service.—An application has been made by Mr. J. Duncan, of 136, Danks Street, Albert Park, Melbourne, for the patent rights for a device which he has invented with a view of saving the time of subscribers to the telephone system. It is claimed that when the device is attached to a telephone it may be adjusted so as to automatically notify the Exchange when the subscriber is out. By this means other people calling for his number can be immediately notified by the Exchange that the subscriber is absent, and they need not waste their time waiting for replies to their calls.

"I must have £1,721,000 this year if the telephone service is to be put on a decent footing. There is no shortage of material now." So said Mr. J. M. Crawford, State electrical engineer of the Postal Department, in giving evidence on March 21st, before the Federal Public Works Committee. The department's engineer added that £2,500 a year would be saved if workshops on modern lines were constructed. A staff of 300 men engaged in the workshops turned out work valued at £60,000 a year. Switches for Queensland were made in New South Wales. Everything was in readiness for the establishment of two new city exchanges. But work could not proceed without approval, and had to remain in abeyance until Parliament met. "Expenditure in my branch has dropped from £620,000 to £250,000 a year, but still I am expected to maintain a standard the same as that existing before the war." Mr. J. M. Paxton, president of the Chamber of Commerce, urged the construction of a Sydney-Brisbane trunk telephone line. It would, he said, be a distinct gain to the commercial community and be extensively used.

Greenland.—Meteorological Station.—Lieut.-Col. E. Gold, assistant director of the Meteorological Office, reports that it has been decided to establish a wireless station in Greenland for daily weather reports. Another development expected in the near future is the establishment of daily weather communications between Britain and Canada.

Ireland.—Wireless Station Attacked.—Dublin Castle reported that at midnight on May 16th fire was opened on the wireless station and the naval wharf at Kingstown. Troops returned the fire, and after an exchange of shots lasting half an hour, during which reinforcements were landed from destroyers in the harbour, the attackers were dispersed.

Luxemburg.—Trunk Telephone Cable.—The installation of an armoured trunk telephone cable 22 miles long has recently been completed between Luxemburg and Diekirch for the Luxemburg Posts and Telegraphs Administration. The cable is a composite one of 36 pairs in multiple-twin formation, and is balanced and loaded for phantom working. It is the first trunk telephone cable to be installed in the Grand Duchy, and is particularly interesting on account of the extremely low values of cross-talk which have been obtained, a very high standard in this respect having been called for. Freedom from cross-talk depends very largely on the skill and care which are exercised in the joining-in of the loading coils, as well as on the balancing of individual loading-coil sections. On loaded lines in this country the coils are usually connected up by the Post Office, so that contractors obtain very little experience of this work, but in this case it was carried out under the supervision of Messrs. British Insulated and Helsby Cables, Ltd., who did all the testing and were responsible for the final results. The loading coils were of the latest dust-core type, and were supplied by the Western Electric Co., Ltd., Woolwich.

On the completed cable, the values of cross talk obtained in any quad, the unit of measurement being one-millionth of the electromotive force applied to the interfering circuit, were as follows:—

Average of all quads, 50 between side circuits and 105 between side and phantom circuits. The three greatest values were 130, 130, 120 between circuits, and 350, 250, 200 between side and phantom circuits.

There is no doubt that this cable far excels any other cable on the Continent in freedom from cross-talk, and Messrs. British Insulated and Helsby Cables, Ltd., are to be congratulated on having achieved this success for British industry.

Orkney Isles.—Proposed Telephone Service.—The secretary to the Orkney Branch of the National Farmers' Union of Scotland, has been informed by the Edinburgh G.P.O. that the Department has promised to make a canvass for subscribers as soon as the present exceptional pressure of telephone work has been dealt with, and that a list of the names and addresses of prospective subscribers would be helpful. A telephone exchange at Kirkwall was an essential preliminary to the linking up of the rural districts with the town. The tariff rental was £1 17s. 6d per quarter for circuits within one mile of an exchange; but a higher charge would be necessary, unless a considerable number of persons rented circuits. Calls would be charged at 1½d. each, with additional fees for connections to exchanges beyond five miles. Agreements would be for an initial term of three years, and quarterly thereafter. It would not be possible to provide telephone connection with the mainland of Scotland.

Railway Wireless.—Mr. Kellaway informed the House of Commons on May 10th that the Midland Railway Co. and, in the case of the London and North-Western Railway Co., the Marconi Co. had been given permission to conduct wireless telegraphic experiments on those two systems. The permission was temporary and could be withdrawn whenever it was considered desirable. The wireless on the railways was to be used solely for the company's business. Wireless was used by the railways during the last railway strike.

Russia.—The "Simuraphon."—Some days ago, at the general meeting of the Russian Society of Road Engineers, the engineer Ap. Phedoroff-Lukoyanof reported on his invention for telephoning any distance through ordinary railway telegraph wires. He calls his apparatus the "Simuraphon," and claims that it is adaptable to wireless telephony over unlimited distances with the aid of a special high-speed generator. He proposes the "substitution of the voltaic arc usually employed" and a special dynamo machine. The "Simuraphon" can, it is said, be connected to any telegraph station, and opens a way to new fields in radio-telephony.

Telegrams Accepted.—The Postmaster-General gives notice that telegrams for all parts of Russia (including Russia-in-Asia as far east as Lake Baikal) are now forwarded over the Anglo-Russian Government cable between Peterhead and Alexandrovsk in Northern Russia, but can only be accepted at the sender's risk. The rates are 5½d. a word for ordinary telegrams and 1s. 4½d. a word for telegrams sent by the "urgent" service. Telegrams can also be forwarded under the same conditions by the Great Northern Co.'s route *via* Libau (Latvia) at 6d. a word for ordinary telegrams and 1s. 6d. a word for "urgent" telegrams.

Spain.—Telephone Service.—A commission appointed by the Spanish Government is visiting Stockholm in order to investigate and report on the Swedish telephone system and Sweden's manufacturing capacity in this line. It is possible that the Spanish Government may enlist the assistance of the leading Swedish telephone concerns, Messrs. L. M. Ericsson and H. T. Cedergren, for the rebuilding and reorganisation of the Spanish telephone system.—*Reuter's Trade Service* (Stockholm).

South Africa.—Telephone Service.—The *British South African Export Gazette* hints to manufacturers of telephone and telegraph supplies that even at the present time the South African demand is in excess of the supply. Although as much as £532,630 has been spent by the Union Government on developing the telephone service since the Armistice, well over 2,500 long-standing applications for installations are still unfulfilled, and the Government has not lost sight of its previous proposals for new automatic systems at Johannesburg, Cape Town, and Pietermaritzburg. Moreover, although much war-time depreciation has been made good, considerable repairs remain to be done, especially in the country areas, and each week sees heavy additions to the list of districts awaiting telephonic communication with the larger towns. In South Africa, too, the demand for equipment by private consumers, as apart from the Government, is on the increase, and last year the imports solely on this account amounted to approximately £30,800, as against only £17,475 in 1919. Add to this a reminder that on last year's official estimates an item of £600,000 appeared for telephonic improvement, additions, and renewals, and that at least a similar sum is expected from Mr. H. Burton's new estimates, and it will be seen that a market of more than ordinary importance is materialising. British makers have, of course, the additional satisfaction of knowing that their pre-war supremacy, temporarily lost to Sweden, has been regained, and that to-day both the latter country and the United States have very little hold on the trade.

U.S.A.—Wireless Fog Signals.—The Secretary of Commerce announces that in view of the important development of a radio compass by the Bureau of Standards, three wireless fog signals are to be immediately installed at the entrance to New York Harbour. Each of these three stations will be equipped with an automatic set which will send out signals continuously during fog or thick weather which may be picked up on shipboard by means of the new radio compass, which indicates the direction from which the signals are sent out, and by taking observations on the different stations the captain of a vessel may determine his exact position without being obliged to rely on the former unsatisfactory method of locating himself by the sound of whistles and fog horns. The method has been developed as the result of co-operative experiments by the Bureau of Standards and the Lighthouse Service, and more especially through the research work of the Bureau of Standards in improving the radio compass. It differs from all other systems in use for determining radio direction in that the navigator himself can determine radio bearings, just as he uses his magnetic compass for bearings in clear weather, and he does not have to depend upon expert radio operators. The other advantage is that the sending apparatus is easily installed and can be operated by the regular light keepers without any skilled personnel, and that any number of vessels at sea equipped with radio compasses may obtain their position at the same time without interference.—*T. & T. Age*,

Miami Cable Dispute.—The endeavours of the State Department to prevent the Western Union from laying the cable to Miami, on the coast of Florida, from the Bahamas, were expected to reach a climax on May 31st, when the Supreme Court was to decide the issue, says *The Times*. The action of the State Department is due to the fear that, if the cable is laid, the Western Union will be enabled to send American cable traffic over the British cable to South America. All the American cable interests object to this, and a Bill has been prepared forbidding cable landings in the United States except by Presidential licence. The Western Union had a cable ship waiting outside the 3 mile limit in readiness to make a landing should the decision of the Supreme Court be adverse to the State Department. The authors of the Bill, spurred on by the State Department, arranged to rush the Bill on

May 16th through both Houses, and thence on to the White House for the President's signature, before the Western Union could act on the expected favourable decision of the Supreme Court.

Both Houses of Congress have accepted the report of the Conference on the Kellogg Bill, which empowers the President to regulate cable landings in the United States, and the measure now goes before the President.—*Reuter's Trade Service* (Washington).

The *Nacion* comments in an unfavourable strain on the decision of the U.S. Congress to prevent the landing of the cable by the Western Union Co. The article points out that the measure affects the interests of Argentina and other countries in South America, and establishes a far-reaching monopoly in favour of American cable companies. The *Nacion* says that in this and other questions which have arisen recently the United States appears to have taken up an attitude of aloofness from the traditions of international co-operation, and has displayed a Pan-Americanism which has each time been more misdirected.—*Reuter's Trade Service* (Buenos Aires).

The Telephone Service.—The amount produced by the telephones in 1914 was £6,645,464, and in 1920 £9,327,418. Charges of collection in the first case were £5,886,536, and in the second £10,792,580, leaving in the latter a deficit of £1,466,086, says the *Daily Mail*.

Wireless Messages to Ships.—SIMPLIFIED PROCEDURE.—Post Offices in London and the provinces will now accept wireless messages addressed to persons on ships at sea (which are within range of the coastal wireless stations of the United Kingdom), without requiring the sender to specify the wireless station through which the message should be transmitted. This new arrangement removes what undoubtedly has been a serious obstacle to the free use of wireless telegraphy between this country and ocean travellers. The counter clerks in the London and provincial offices have instructions to accept messages for ships of all nationalities provided it is known that those ships can be communicated with direct by the coastal wireless stations of the United Kingdom. The messages so accepted are sent to a "routing bureau" in London, whence they are distributed according to the movements of the vessels to which they are addressed.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared.)*

OPEN.

Australia. — MELBOURNE. — June 15th. Victorian Government Railways. 50 oil-immersed single-phase track and signal transformers for power signalling (Contract No. 33,901).*

June 22nd. One electric lifting magnet (capacity ½ ton), one 440-V motor generator.*

June 29th. Supply of 1-ton platform type industrial storage battery trucks, also battery-charging equipment.*

August 10th. 250 core-type impedance bonds for power signalling, with a capacity of 1,000 amperes per rail; also 50 miles of solid insulated copper wire, No. 14 Brown & Sharpe gauge, and 50 miles of solid insulated copper wire, 16 standard gauge.

August 17th. 3,000 sets of renewals for caustic soda primary cells.

August 30th. Board of Works. Four electrical centrifugal pumps, each with a capacity of twelve million gallons daily.

Belgium.—June 30th. Municipal authorities at Lokeren. For an underground system of electricity supply mains. Particulars (15 francs) from the Directeur des Services du Gaz et de l'Electricité de la Ville de Lokeren. Tenders to the College des Bourgmestres et Echevins, Hotel de Ville, Lokeren, by registered post.

June 8th. Post and Telegraph authorities at La Salle Madeleine, Brussels. Telephone cable. Particulars (3 francs) by applying for Cahier des Charges Special No. 605.

Municipal authorities of Ghent. Installation of electric lighting in the sheds of the outer port, the small dock, and the new maritime buildings.

Brighton.—June 7th. Electricity Department. Oil fuel plant. (May 20th)

Dundee.—June 6th. Electricity Department. One coupled motor-generator, consisting of two interpole machines; motor, 400 V, d.c.; generator, 75 V, 130 amp.; also regulator, 60 to 70 V. (May 20th.)

Glasgow.—May 31st. Electricity Department. Cables (including small i.r. cables and flexibles) and meters for twelve months. (May 13th.)

Greenock.—June 6th. Corporation. Electric lighting work in connection with the Upper Cornhaddock housing scheme (18 tenements and six double cottages). Schedules, &c., from Office of Public Works, Greenock.

Huddersfield.—May 28th. Electric light installation in United Methodist Church and School, Outlane. Mr. F. Roberts, Maplin Lea, Lindley Moor, Outlane.

Lanark.—County of Lanark (District of the Lower Ward). Electric lighting work in connection with housing schemes. Mr. J. A. McCallum, District Clerk, 15, West George Street, Glasgow.

Leytonstone.—June 16th. West Ham Union. Three months' supply of electrical fittings. Mr. T. Smith, Clerk, Board Room, Union Road, Leytonstone, E.11.

Liverpool.—June 6th. Liverpool Overhead Railway Co. Stores, including electrical fittings for twelve months. General Manager, 31, James Street, Liverpool.

London.—SHOREDITCH.—June 7th. Electricity Department. Constructional steel and ironwork building, 20-ton weighbridge, h.p. steam pipes, valves, &c., for Whiston Street generating station. (May 13th.)

New Zealand.—June 28th. Public Works Department. Ten a.p. oil-filled transformers for the conversion of three-phase energy at 50 cycles, the voltage ratio being 50,000/11,000, for Waikato power scheme.*

June 28th. Supply and delivery at Lyttelton of two 50-kVA, two 100-kVA, and two 200-kVA condensers in connection with the Lake Coleridge electric power supply (Section 116).*

WELLINGTON.—June 14th. Post and Telegraph Department. 7,460 lamps, various voltages.*

August 9th. Public Works Department. Suspension type porcelain insulators for the Waikato power scheme.*

South Africa.—July 5th. Electrification of Capetown-Simonstown and Durban-Maritzburg railway lines.

RHODESIA. — BULAWAYO. — August 3rd. Municipal Council. Electric light and power plant. (See this issue.)

TRANSVAAL.—Rand Water Board. September 9th. Erection of a complete installation of mechanical or other filters capable of filtering 5½ million gallons of water per 24 hours at the Vereeniging main pumping Station (Contract No. 232). Copies of the contract documents may be obtained from the Chief Engineer, Rand Water Board, Johannesburg, upon a deposit of three guineas, but specifications, blue prints, &c., may be inspected at the Inquiry Room of the Department of Overseas Trade, 35, Old Queen Street, Westminster, S.W. 1.

*** A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.**

CLOSED.

Australia.—MELBOURNE.—Morwell electric scheme. The tender of the American Aluminium Co. has been accepted for aluminium steel conductors at £91,416 at port of shipment. At the present rate of exchange the landed cost in Melbourne will be £30,000 less than the lowest tender for copper conductors. The whole equipment will be manufactured and shipped from Canada. —*The Times.*

Victorian Railways. Accepted:—

Four 4,500-kW converter sets (for Jolimont sub-station), with all accessories, £90,010; extra for magnetic blow-out d.c. brushgear, £1,870; eight 1,000-kW automatic converter equipments for various sub-stations, £92,305; extra for magnetic blow-out brushgear, £1,100.—British Thomson-Houston Co., Ltd. —*Tenders.*

Littleborough.—The Housing Committee of the Urban District Council has recommended acceptance of the tender of E. Taylor & Co. for electric lighting in connection with the housing scheme.

London.—ST. PANCRAS.—Electricity and Public Lighting Committee. Supply of l.p. and h.p. cable, various lengths and sizes:—

Firm.	L.p. cable.	H.p. cable.
Hackbridge Cable Co., Ltd.	£9,739	£4,461
Enfield Ediswan Cable Co., Ltd.	10,519	2,682
Siemens Bros. & Co., Ltd.	10,916	2,461
Western Electric Co., Ltd.	10,987	2,429
B.I. & Helsby Cables, Ltd.	11,029	2,461
Johnson & Phillips, Ltd.	11,049	2,484
W. T. Henley's Tel. Works Co., Ltd.	11,118	2,461
W. T. Glover & Co., Ltd.	11,159	2,472
Union Cable Co.	11,341	2,528
Callender's Cable Co., Ltd.	11,606	2,599
Pirelli-General Cable Co., Ltd.	12,163	2,787
Wanhams	13,116	2,818
Macintosh Cable Co., Ltd.	12,741	2,738
New Gutta-Percha Co., Ltd.	12 316	4,015

The Committee recommends the acceptance of the offer of the Hackbridge Cable Co., Ltd., at £9,739, for the supply of l.p. cable; and that of the Western Electric Co., Ltd., at £2,129, for h.p. cable.

HAMMERSMITH.—Electricity Committee. 425 house service and joint boxes of various descriptions:—

W. Lucy & Co., Ltd, £369 (recommended).

Mains extension sub-station equipment.

Hammersmith feeders.—Two 15"-amp. split-conductor feeder panels, £601; one 2,000-kW splitter panel, £469; one 3,000-kW 2-phase panel, £217; total, £1,077. Kensington feeders. Two 12½-amp incoming feeders, £334; two 12½-amp. outgoing feeders, £363; one 2,000-kW splitter panel, £214; synchronising gear, £81; two wattmeters, £166; total, £1,099.—Fergu on, Pailin & Co. (recommended).

Eight 250-amp., h.p. switch panels, £376.—Park Royal Engineering Co. (recommended).

Two condensate pumps for Nos. 12 and 15 turbines, £293.—Gwynne's Engineering Co., Ltd. (recommended).

New Zealand. — WELLINGTON. — Municipal Council. Subject to a satisfactory arrangement regarding the proposed loan of £500,000 for electric supply purposes, the Finance and Legal

Committee of the Wellington, N.Z., Council has recommended for acceptance the following tenders :—

Section A—Generator plant, British General Electric Co., £93,675. Remainder of machinery, British Thomson-Houston Co., £77,150.
Section B—Boilers, Babcock & Wilcox, £81,000.
Section C—Cables, Callender's Cable Co., £17,200.
Coal-handling plant, £16,700; total, £.85,025.

The Electrical Engineer recommended the acceptance of the lowest tender in each section, the list being as follows :—

Section A—English Electric Co., £191,000; Metropolitan-Vickers, £181,000; British Thomson-Houston Co., £186,000; Brush Co., £418,000; British General Electric Co., £172,000.
By selection of the British General Electric Co.'s price for the generator plant and that of the British Thomson-Houston Co. for the remainder of the machinery, the whole will be obtained for £1,175 less than the lowest tender for the whole.
Section B—Babcock & Wilcox, £81,000; Stirling Boiler Co., £82,525.
Section C—Callender's Cable Co., £17,500; British Insulated & Helsby Cables, Ltd., £18,450; W. T. Henley's Telegraph Works Co., Ltd., £17 645; Western Electric Co., £24,22 ; Siemens Bros & Co., £19,550; Glover & Co., £20,500; Pirelli-General Cable Co., £18,300; Johnson and Phillips, Ltd., £21,850. —*Tenders.*

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, May 27th. At the Institution, Storey's Gate, Westminster, S.W. At 6 p.m. Special meeting.

Junior Institution of Engineers.—Friday, May 27th. At Caxton Hall, Westminster, S.W. At 8 p.m. "Notes on Electrical Transformer Breakdowns," by Mr. S. A. Stigant.

Physical Society of London.—Friday, May 27th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary meeting.

Royal Society of Arts.—Friday, May 27th. At John Street, Adelphi, W.C. At 4.30 p.m. Paper on "Industrial (including power) Alcohol," by Sir C. H. Bedford.

Faraday Society.—Tuesday, May 31st. At Burlington House, Piccadilly, W. General discussion on "Physico-chemical Problems Relating to the Soil." Afternoon session, 4.30 to 6.30 p.m. Evening session, 8 to 10.30 p.m.
Wednesday June 1st. Visit to Rothamsted Experimental Station.

Illuminating Engineering Society.—Tuesday, May 31st. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8.15 p.m. Discussion on "The Use of Artificial Light as an Aid to Various Games and Sports," to be opened by Mr. J. S. Dow. Annual meeting.

Institution of Electrical Engineers.—Tuesday, May 31st. At 5 p.m. At the Institution, Victoria Embankment. Annual general meeting, 5.45; special general meeting, 6.30 p.m. Lecture on "Research Work in the United States," by Dr. F. B. Jewett.

Institution of Railway Signal Engineers.—Wednesday, June 1st. At the Midland Grand Hotel, St. Pancras. At 3 p.m. Resumed discussion on "Track Circuit Nomenclature and Track Circuit Record Forms."

Chemical Society.—Thursday, June 2nd. At Burlington House, W.1. At 8 p.m. Ordinary scientific meeting.

Engineers' Club.—Thursday, June 2nd. At the Hotel Cecil, Strand. At 2.30 p.m. General meeting of supporters.

International Rubber Exhibition.—June 3rd to June 17th. At the Royal Agricultural Hall, Islington.

NOTES.

Protection for X-Ray Operators.—The preliminary meeting of the X-Ray and Radium Protection Committee has been held. The Committee is composed of radiologists, physicists, pathologists, and others nominated by the Electrotherapeutic Section of the Royal Society of Medicine, the British Association for the Advancement of Radiology and Physiotherapy, the Institute of Physics, the Röntgen Society, and the National Physical Laboratory, and is under the chairmanship of Sir Humphry Rolleston. The intention of the Committee is to issue very shortly a considered statement as to the urgency of affording adequate protection to the worker, indicating the best means whereby it may be carried out. For this purpose a sub-committee has been appointed. It is the Committee's further intention to collect data bearing on the effect of irradiation, with particular reference to protection ; to carry out special research, if necessary ; to act in a consultative and, possibly, advisory capacity, and to publish from time to time such reports as are considered necessary.—*Morning Post.*

Women Engineers.—The Hon. Lady Parsons presided on May 20th at the general meeting of the Women's Engineering Society. It was stated that the industrial upheavals and consequent depression in trade had not been particularly favourable to the efforts of women to gain a firmer foothold in the engineering world. The most significant sign of the progress made was that practically all the engineering institutions had decided to admit women to membership, provided that they had the necessary qualifications. An increasing number of women were taking an active part in the control of engineering works, and another interesting development had been the formation by members of the society of a small engineering company.—*Morning Post.*

Post Office Managed by Workers.—The annual conference of the Union of Post Office Workers concluded at Edinburgh on May 13th. A resolution moved by the executive proposed to add to the objects of the Union "the organisation of Post Office workers into one comprehensive industrial Union with a view to the service being conducted and managed as a national guild." Mr. Larsen, who moved it on behalf of the executive, said that when all grades of postal workers were in one Union, they would go to the community and say : "We will take on this job and provide a postal service, running it on democratic lines with the primary object, not of making a profit, but of meeting the needs of the community." The resolution was carried by a very large majority.—*The Times.*

Mme. Curie's Gift of Radium.—Mme. Curie was presented, on May 20th, with one gramme of the precious metal (about $\frac{1}{3}$ oz.), worth £20,000, by the women of the United States. The presentation took place at the White House, in the presence of President and Mrs. Harding, Mme. Jusserand, the wife of the French Ambassador, and Princess Lubomiraki, the wife of the Polish Minister. Mme. Curie was accompanied by her two daughters. "We welcome you as an adopted daughter of France, our earliest supporter among the great nations," said the President in making the presentation. "We greet you as foremost among scientists in the age of science, as leader among women in the generation which sees woman come tardily into her own."—*Daily Mail.*

Carnegie Funds Awards to Scientists.—The committee of the Carnegie Foundation met on May 21st at Paris, under the presidency of M. Emile Loubet, the former President, and made the following awards :—

Gold medal to Dr. Infroit, who has had several fingers amputated as the result of disease contracted in the course of his X-ray experiments.

Gold medal and £2,000 to M. Vaillant, head of the X-ray laboratory at the Saltpetriere Hospital, who has continued his work in spite of losing his left arm.

Gold medal to the late Dr. Leray, who died on March 26th from burns contracted during his work on radiology.—*Sunday Pictorial.*

Finsbury Old Students' Association.—In connection with the recently formed Manchester Section of the Finsbury Technical College Old Students' Association, a smoking concert was held at the Grand Hotel on April 29th. Those members who were fortunate enough to be present were treated to an excellent programme, and altogether a most enjoyable evening was spent. Although the membership is gradually increasing, it is felt that it should do so much more rapidly, and to this end any old students desirous of joining the Section are asked to write to the Local Honorary Secretary, Mr. H.F. Coucher, 9, Cartright Road, Chorlton-cum-Hardy, or to Mr. Eustace Thomas.

Appointments Vacant.—Lecturer in electrical science, including electrical engineering science (£300-£350), demonstrator and laboratory assistant, mechanical engineering (£200-£250), for the Birkenhead Education Committee ; e.h.p. plumber-jointer (106s.), for the Newport Borough Council Electricity Department ; electrical engineer and manager, for the Wallasey Corporation. See our advertisement pages to-day.

Educational.—FINSBURY TECHNICAL COLLEGE, Leonard Street, City Road, E.C.—Prof. W. H. Eccles, F.R.S., Dean for the session 1921-22. The entrance examination for the forthcoming session will be held on September 20th. Applications for admission should be forwarded to the College by September 15th on forms to be obtained from the Registrar, Leonard Street, E.C. For further particulars see our advertisement pages to-day.

Electrical Trades Benevolent Institution.—We have received a publication embodying the report of the Committee for the year 1920, a report of the annual general meeting, a report of the annual festival held on December 15th, 1920, a list of governors, members, subscribers, and donors, and the rules of the Institution.

An Electricity Advisory Committee.—To enable a closer link to be formed between the Liverpool University and the electrical engineering in the district, there has recently been appointed an advisory committee by the Faculty of Engineering to advise it as to the best course of training for prospective electrical engineers. The committee has just held its first meeting, and in addition to the professors of the Department of Electrical Engineering and the Engineering Faculty, there were also present Mr. H. Dickinson, Liverpool city electrical engineer ; Mr. A. P. M. Fleming, C.B.E., of the Metropolitan-Vickers Co. ; Mr. R. D. Livingstone, of the English Electric Co., Preston ; Mr. B. Welbourn, of the British Insulated and Helsby Cables, Ltd. ; Mr. H. H. Harrison, of the Automatic Telephone Co., and others.

A New Photo-Electric Cell.—The report of the spring meeting of the American Electrochemical Society, appearing in *Chemical and Metallurgical Engineering*, states that B. S. Cushman, of Auburn, N.Y., presented a highly interesting paper, by T. W. Case, on a photo-electric effect in audion bulbs of the oxide-coated filament type. Mr. Case reported that he had been able continuously to record daylight intensity for several months past. The photo-electric effect on barium and strontium filaments in audion bulbs furnishes a current of 100 to 150 micro-A, which actuates an automatic recorder. Mr. Cushman showed two strontium cells, and reproduced on the screen a number of daylight records which had been automatically registered by a Leeds & Northrup potentiometer. One of the cells had almost the same sensitivity as that of the human eye to light. The barium cells are sensitive to the longer rays, the strontium cells to the shorter rays.

Vegetable Electricity.—The inaugural lecture of a series of eight on "Experimental Studies in Vegetable Physiology and Vegetable Electricity" was delivered by Dr. A. D. Waller, assisted by Mr. J. C. Waller, at the University of London, on May 18th. A distinct analogy, said the lecturer, existed between animal and vegetable electricity. He connected a plant by two electrons (*sic*) to a keyboard, submitted it to electrical excitation, and obtained an electrical response. The response of the plant was always in the same direction. The plant was next electrocuted without being destroyed. The lecturer said it would take two hours for the plant to recover.—*Morning Post.*

Report on the Metric System.—In September last we reviewed the report issued by the Metric Committee appointed by the Conjoint Board of Scientific Societies, and pointed out that the report had not been adopted by the Conjoint Board, but was issued solely on the authority of the Committee.

Recently we have received from the secretary to the Committee a "Brief Account of the Report," written by him, and "approved by the chairman for the information of the Press," but not submitted to the Metric Committee. This abstract is a fair one and we take no exception to its composition; but we do protest against its issue at this time, eight months after the issue of the report, as a result of which it has been dealt with in many periodicals as though it related to a recent report, an impression which is assisted by a covering note which refers to "the report . . . communicated to you some little time ago." Eight months is not a "little time," and whatever the object of the communication, its issue now has the air of an attempt to secure fresh publicity for a document which, even in the first instance, was not approved by the Board.

Service Notes.—Commissioned Electrician J. B. Clough has been posted to the battle cruiser *Hood*, from the 17th inst. Commissioned Electrician T. R. Brotheridge joins the *Defiance* from the battle cruiser *Hood*. Warrant Electrician J. H. Whittaker has been appointed to *H.M.S. Vernon*, for duty with the Royal Navy Torpedo Factory, Greenock. On recommissioning, Warrant Electrician W. H. Smallwood has been appointed to the battleship *Conqueror*. Lieutenant R. Sharp, O.B.E., and Lieutenant E. H. E. Woodward, M.C., Tyne Electrical Engineers, have been appointed temporary captains, from the 12th and 17th ult. respectively, in the Defence Force.

INSTITUTION NOTES.

Institution of Electrical Engineers. — VISIT OF DUTCH ENGINEERS. Under the auspices of the Institution, a party of Dutch electrical engineers is on a visit to this country. The visitors, who are representative of Governmental, municipal, and commercial activities, are Messrs. J. G Bellaas Spruty, G. J. F. Bakker, and C. Noone (respectively president, secretary, and second secretary of the Association of Managers of Dutch Electricity Undertakings), and Messrs. E van Dijk, E. B. van Doesburgh, H. Lohr, J. C. van Staveren, W. Lulofs, and A. B. van Hamel. A very full programme was arranged. On May 22nd the party arrived, and was conducted to the Hotel Cecil, and in the afternoon the visitors went up-river to Tazg's Island and Weybridge. On May 23rd visits were paid to the I.E.E. Building, St. Stephen's Club, and Henley. Oxford, Eltington Park, and Hereford were the itinerary on the 24th. The next day (25th) the places seen were Shrewsbury and Manchester; and on the 26th various Manchester works were visited, and the day concluded with a dinner given by the municipality. The party returns to London to-day, leaving for Holland to morrow morning.

Incorporated Municipal Electrical Association.—The President and Council have very carefully considered the possibility of holding the Convention in Dundee and neighbourhood, from June 13th to 17th next, and have reluctantly come to the conclusion that, in view of the conditions prevailing, they have no other course open but to cancel the Convention for this year. The annual general meeting will be held in London on July 22nd, and in order that members may have an opportunity of meeting one another, the Council proposes to hold the annual dinner (to which ladies are invited) on the previous evening.

Institute of Metals.—In connection with the annual autumn meeting to be held in Birmingham from September 20th to 23rd, a Reception Committee has been formed under the presidency of Sir Gerard Muntz Bart., and an attractive programme has been arranged. This includes a garden party and motor excursion to Warwick, Kenilworth, and Stratford-on-Avon.

The Röntgen Society.—At the general meeting of the Society on May 19th, Madame Curie, of Paris, was elected an hon. member, and the fourth Silvanus P. Thompson memorial lecture was delivered by Prof. A. V. Hill, F.R.S., of Manchester University, who took as his subject "Electrical Instruments and Phenomena in Physiology." The annual general meeting of the Society will be held on June 16th and the Society's exhibition will be held at the Royal Photographic Society during the whole of June, 1921. It is hoped that a set of prints of outstanding interest will be contributed, and the Council expresses the wish that members will do their best to support it and make the exhibition an unqualified success. The President, Dr. Robert Knox offers silver and bronze plaques for the best and second-best collection of four prints, the work of an assistant employed at a hospital or working for a qualified radiologist. This section will be open to workers whether members of the Röntgen Society or not. The President of the Royal Photographic Society has consented to judge the entries in this section and his awards will be final.

Royal Institution.—The Friday evening lecture on June 10th will be delivered by Dr. A. G. Webster, on "Absolute Measurements of Sound." An extra discourse will be given on June 17th by Sir J. J. Thomson, on "Chemical Combination and the Structure of the Molecule."

Wireless Societies.—The Wandsworth Wireless Society has just been formed, with headquarters at the Wandsworth Technical Institute, the Governors of which have offered the use of the physics laboratory for the work of the Society. Mr. F. V. Copperwheat, 9, Birdhurst Road, Wandsworth, has been elected secretary, and a general meeting of the Society was to be held at headquarters this evening (May 27th) when Mr. D. N. Griffiths, B.Sc., A.M.I.M.E., was to preside.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Hammersmith Borough Council Salaries and Wages Committee has had under consideration the recommendation of the Electricity Committee on the subject of increasing the salary of the borough electrical engineer, MR. G. G. BELL. In 1919 the Council approved the application of the formula of the A.M.E.E. (Greater London) with regard to his remuneration, which yielded approximately £1,200 per annum: at present it is slightly below this amount. Having regard to the growth of the undertaking since the electrical engineer's salary was last revised, the schemes which the Council adopted for the extension of the generating plant and mains without the assistance of a consulting engineer, and the reduction in generating costs effected by the use of powdered fuel (which reductions will be increased as the plant is extended), the Electricity Committee is of opinion that the basic salary in the formula should be increased from £750 to £900, the rest of the formula to be applied as at present, subject to the provision that the total remuneration shall not exceed £1,500 per annum without the position being further reviewed. By this variation, the present salary would be fixed at approximately £1,330 per annum. The Salaries and Wages Committee recommends that the remuneration should be increased as proposed.

At the conference of the Electrical Trades Union, at Blackpool, on Saturday, a gold watch was presented to MR. J. W. BALL, of Manchester, by Mr. Humphries, of London, in recognition of 20 years' service to the Union. The conference decided against affiliation with the Third International.

Hammersmith Borough Council Electricity Committee has appointed MR. C. E. ACOCK to the position of engineer-in-charge, and MR. F. V. JORDAN assistant mains engineer. The total number of applications were 68 and 39 respectively. Mr. Acock has since intimated his inability to accept the appointment.

MR. CYRIL MORGAN, late of the Newport Corporation electrical staff, has gone to Madras to take up an appointment.

MR A. E. VAL DAVIES has resigned his position as assistant city electrical engineer to the Cape Town Municipal Council, and has been appointed consulting electrical engineer to the Pretoria Portland Cement Co.

MR. A. S. BENNI, vice-chairman of Messrs. Ercole Marelli & Co., S.A.I. Milan, and a director of Messrs. Ercole Marelli & Co., Ltd., London, was returned Member for Milan (National Party), at the recent General Election in Italy.

MR. JAMES M. WAKEMAN has resigned the position of general manager of the Society for Electrical Development, Inc. (U.S.A.). MR. WILLIAM L. GOODWIN, assistant to the President, is taking over the duties.

MR. HARRY HUGHES, electrician at the Fochriw Colliery, was married at Rhymney, South Wales, on May 17th, to Miss Mary Tyler.

The Times announces that DR. J. RUSSELL REYNOLDS has been appointed radiologist at Charing Cross Hospital, in succession to Dr. Ironside Bruce, who died a month ago as the result of continued exposure to high power X-rays.

Obituary.—MR. A. R. CONNAL.—We regret to record the death which occurred at his residence at Shortlands, Kent, on Saturday last, of Mr. Allan Ramsay Connal, A.M.I.E.E. The deceased gentleman, who was 41 years of age, was London manager and engineer of Messrs. Johnson & Phillips, Ltd. The funeral took place yesterday at Highgate Cemetery.

MR. R. ROBERTSON.—Mr. Robert Robertson, commercial manager of the Clyde Valley Electrical Power Co., died suddenly at his residence, Llangsernie, Prestwick, Ayrshire, on Thursday last week, from heart failure. Mr. Robertson, who was well known and greatly esteemed in commercial circles, was only 47 years of age.

MR. H. GUN.—The death took place on May 14th of Mr. Henry Gun, a former Mayor of Okehampton, who for many years carried on the business now conducted by Messrs. Blatchford, electrical engineers. He was 75 years of age.

DR. E. B. ROSA.—*The Times* announces the death of Dr. Edward B. Rosa, chief physicist at the Bureau of Standards, Washington, U.S.A., on May 17th. One of America's leading scientists he was known to scientific men in England from his attendance at meetings of the British Association, and by his numerous publications on electrical investigations. He had been secretary of the International Scientific Association.

SIR JAMES PENDER.—We regret to record the death, in his 80th year, of Sir James Pender, eldest son of the late Sir John Pender, one of the pioneers of submarine telegraphy. Sir James was a director of the Telegraph Construction and Maintenance Co., Ltd., the Globe Telegraph and Trust Co., Ltd., the Direct United States Cable Co., Ltd., the Electric Construction Co., Ltd., and other undertakings.

MR. P. D. HOLLINGS.—*The Times* records the death, at Woking, at the age of 35 years, of Mr. Percival D. Hollings, a well-known

chemist, who rendered great service to the Government during the war. "A talented linguist, he went to Russia in 1913 to organise the works of Leitner's Electrical Co., at Moscow, and in 1915 was appointed superintendent of train-lighting on the Great Western Railway. At the time of his death he was acting as manager of Accumulators of Woking, Ltd."

MR. A. SPARK.—Mr. Alexander Spark, electrical engineer and scientific instrument maker, at Aberdeen, passed away on 18th inst., at the age of 73 years. He had been in business on his own account at Aberdeen since 1871.

MR. CHARLES LOUIS OECHSNER.—Mr. Oechsner, to whose decease we referred briefly last week, was a man of genial personality, which made for him a large circle of friends in the engineering world. He was 55 years of age, having been born in 1866, at New Orleans, La., U.S.A. He had been associated with various activities of the British Thomson-Houston Co. since 1888, joining the London staff in 1899, and the Rugby staff in 1901. He will be greatly missed, not only by his many friends in the B.T.H. organisation, but by those who knew him during his long association with the company. The funeral took place at Bournemouth, on Thursday, May 19th.

The death occurred at Tredegar, on Sunday, of MR. JAMES PHILLIPS, for many years assistant chief electrician to the Tredegar Iron and Coal Co.

Will.—The late MR. E. R. SHELDON, of Cowans, Sheldon & Co., Ltd., of Carlisle, left £100,797 gross, and £89,960 net personalty.

NEW COMPANIES REGISTERED.

British Scott Telecator Co., Ltd. (174,725).—Private company. Registered May 17th. Capital, £25,000 in 22,500 10 per cent. cumulative shares of £1 and 50,000 ordinary shares of 1s. each. To acquire a certain invention relating to an apparatus known as the telecator for indicating and locating defects in the working of internal combustion engines, and to carry on the business of manufacturers of or dealers in motor vehicles and conveyances of all kinds, &c. The permanent directors are: W. T. Parez, "Upwood," Haywards Heath; A. J. Barber, 16, Eldon Street, E.C.2; Qualification £100. Secretary: A. J. Barber. Solicitor: P. W. Butcher, 13, Bouverie Street, Fleet Street, E.C.4. Registered office: 16, Eldon Street, E.C.2.

Flash Gun, Ltd. (11,727).—Private company. Registered in Edinburgh May 17th. Capital, £2,000 in £1 shares. To carry on the business of electricians, mechanical engineers, toy makers, electric gun, rifle, revolver and pistol makers, &c. The first directors are: W. G. Paterson, 37, Garnethill Street, Glasgow, engineer; G. A. Rannie, 39, Smith Street, Hillhead, Glasgow, mining agent; C. Kirkwood, 61, West Regent Street, Glasgow; J. G. Aitchison, 1732, Shottleston Road, Shottleston, Glasgow; R. Carswill, 204, St. Vincent Street, Glasgow. Secretary: R. Carswell. Registered office: 204, St. Vincent Street, Glasgow.

Allan & Magowan, Ltd. (11,725).—Private company. Registered in Edinburgh May 16th. Capital, £15,000 in £1 shares. To take over the business of power engineers and contractors carried on by A. M. Allan, W. J. Magowan, A. Forrest, and J. A. Barr as "Allan & Magowan" at 288-292, Shields Road, Glasgow, and elsewhere. The first directors are: A. M. Allan, 288-292, Shields Road, Glasgow, power engineer and contractor; W. J. Magowan, 288-292, Shields Road, Glasgow, power engineer and contractor; A. Forrest, 288-292, Shields Road, Glasgow, power engineer and contractor; J. A. Barr, 288-292, Shields Road, Glasgow, power engineer and contractor. Solicitor: W. G. Shaw, 97, Wellington Street, Glasgow.

Youldon & Keeling, Ltd. (174,576).—Private company. Registered May 5th. Capital, £600 in £1 shares. To carry on the business of general engineers, motor and dynamo manufacturers, scientific instrument makers, &c. The first directors are: C. A. Youldon, 240, Camden Street, N.W.; T. H. J. Keeling, St. Cuthbert's, Salters Hill, Upper Norwood, S.E.19. Registered office: 26-31, Eyre Street Hill, Clerkenwell Road, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Worcester Electric Traction Co., Ltd.—Satisfaction in full on April 20th, 1921, of mortgage dated February 12th, 1914, securing £1,000.

High Temperature Generators (1918), Ltd.—Debenture dated April 28th, 1921, to secure £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: J. H. S. Hanning, 3, Copthall Buildings, E.C., and others.

Scarborough Electric Supply Co., Ltd.—Mortgage on certain premises in Scarborough and company's undertaking and property, including uncalled capital dated April 29th, 1921, to secure all moneys due or to become due from company to London County Westminster & Parrs Bank.

Milford-on-Sea Electric Supply Co., Ltd.—Particulars of £400 debentures authorised March 29th, 1921, whole amount issued. Charged on the company's property, present and future.

Anglo-Mexican Electric Co., Ltd.—Satisfaction in full on March 15th, 1921, of trust deed dated March 2nd, 1906, securing £300,000.

Lancashire United Tramways, Ltd.—Trust deed dated April 26th, 1921 (supplemental to trust deed dated April 27th, 1906, securing £300,000 debenture stock), charged on a mortgage for £145,517 7s. granted by South Lancashire Tramways Co. to trustees in lieu of certain land and premises in Hindley and Atherton, Lancs. Trustees: Rt. Hon. Viscount St. Davids and M. B. Snell, 5, Copthall Buildings, E.C.

Tutbury Engineering Co., Ltd.—Satisfaction to the extent of £1,000 on February 11th, and £1,000 on February 22nd, 1921, of debentures dated July 1st, 1915, securing £2,000.

Thermal Syndicate, Ltd.—First mortgage debenture dated April 21st, 1921, to secure £20,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holders: J. J. Garnett and W. D. Forster, Collingwood Street, Newcastle-on-Tyne.

Franklin Engineering Co., Ltd.—Further charge dated April 25th, 1921, to secure £3,000, and debentures of even date (as collateral security) to secure £8,000 (both additional securities for mortgage dated October 21st, 1920, securing £5,000). Charged on Royal Oak Inn, Canton, Cardiff, and the company's undertaking and property, present and future, including uncalled capital. Holder: P. Evans, Holme Tower, Penarth.

T. Beadle & Co., Ltd.—Mortgage dated May 2nd, 1921, to secure £1,000, charged on 3, 4, and 5, Castle Street, and Boyes Yard, Castle Street, Hull. Holders: Dr. L. Carrol, Butler House, Barkerend Road, Bradford, and others.

Northampton Electric Light and Power Co., Ltd.—Issue on April 20th, of £28,554, on April 30th, of £450, and on May 2nd, 1921, of £700 second debenture stock, parts of a series already registered.

Kensington & Knightsbridge Electric Lighting Co., Ltd. (26,193).—Return dated March 31st, 1921. Capital, £350,000 in £5 shares (50,000 ordinary, 10,000 first preference, and 10,000 second preference), 21,000 ordinary, 10,000 first preference, and 10,000 second preference shares taken up. £179,840 paid. £25,160 considered as paid. Mortgages and charges, £140,000; also guaranteed jointly by this company and the Notting Hill Electric Lighting Co., Ltd., under the Kensington & Notting Hill Electric Lighting Co.'s Act, 1899; £225,000.

Lancashire United Tramways, Ltd. (87,044).—Return dated March 15th, 1921. Capital, £200,000 in £1 shares. 192,878 shares taken up. £7 paid. £192,871 considered as paid. Mortgages and charges, £546,500. Deferred stock issued having no charge over company's assets, £83,330. NOTE.—A further £20,000 of this stock has been deposited as security for possible advances.)

Oxford Electric Co., Ltd. (34,685).—Return dated March 21st, 1921. Capital, £175,000 in 20,000 ordinary and 15,000 preference shares of £5 each. 20,000 ordinary and 11,000 preference shares taken up. £122,550 paid on 13,200 ordinary and 11,000 preference, including £1,550 paid on 310 ordinary shares forfeited. £34,000 considered as paid on 6,800 ordinary. Mortgages and charges, £75,000.

Para Electric Railways & Lighting Co., Ltd. (85,368).—Return dated March 25th, 1921. Capital, £780,000 in £1 shares (390,000 preference and 390,000 ordinary). 325,000 preference and 390,000 ordinary shares taken up. £25,040 paid. £689,960 considered as paid. Mortgages and charges, £618,016.

CITY NOTES.

Siemens Bros. and Co., Ltd.

Mr. G. Mure Ritchie presided on Monday at the annual meeting of this company. He dealt at some length with the balance sheet items, and pointed out that, while the total assets amounted to £3,552,341, the total liabilities, other than share capital, were only £1,561,272, leaving a balance of assets of £1,991,069 to represent the share capital of £1,259,062. The profit and loss account showed a net profit of £253,254, as compared with £211,209 in 1919. With the amount brought forward, £315,776, there was a balance of £569,030 available for appropriation. Already an interim dividend of 5 per cent., free of tax, had been paid, and £30,000 had been transferred to special surplus fund. A final dividend of 1s. per share, free of tax, making 10 per cent. for the year, was recommended, leaving £435,218 to be carried forward. With regard to the proposed increase of capital and bonus distribution, the whole of the authorised capital, £1,500,000 was issued and fully paid up. Any addition to the ordinary share capital was to be avoided if the company could issue new capital on another basis. The creation of £1,000,000 of 10 per cent. preference shares would place at the disposal of the board capital powers for future requirements. In a progressive and prosperous business the necessity for additional capital recurred, and it should be provided, in order to expand operations and augment profits. It seemed right to the directors before admitting new shareholders to a participation in the capital of the concern, to distribute among existing shareholders a portion of the surplus assets so that they and the newcomers would stand on something approaching an equal footing. The preference shares proposed to be created would rank for dividend as from July next, and would be allotted to existing shareholders in the proportion of one new preference share for every five ordinary shares held. He wished to make it clear that the bonus distribution did not trench upon the company's various reserve funds, which amounted to over £212,000. As to the trade position, the total value of orders received in 1920 amounted to £4,025,685, against £2,834,712 in 1919. The company was fortunate in having a world-wide reputation and far-reaching trade connections in Britain and her overseas dominions, and in foreign countries. The variety of their more important manufactures was such that, as in 1920, if orders fell off in some lines, they increased in others, so that on balance the business and profits had grown in the year. He was glad to say that, while last year was substantially better than 1919, the directors expected 1921 to be better than 1920, and no difficulty was anticipated in maintaining for 1921 the 10 per cent., free of tax, ordinary distribution. Of the more remote future, he could not be expected to prophesy, but he had every confidence that on the whole Siemens Bros. would continue to expand and prosper. Speaking of the various departments of the business, he first referred to cables. During the year this department had been fully occupied, particularly the submarine telegraph section, and those dealing with underground super-pressure power mains and trunk telegraph lines. With regard to submarine cable, which had been made at Woolwich for more than half a century, the output in 1920 was greater than in 1919. During the year submarine telegraph and telephone cables were made for use in many parts of the world, and in the Atlantic and Pacific Oceans, the Mediterranean, the Red Sea, the Baltic, the Sea of Japan, and along the coasts of Chile and Peru their manufactures were playing an important part in communications. In underground telephone cables the demand for the paper-insulated type had increased,

and the factory had been fully occupied. The export business in loop cables had also increased. The volume of business in the apparatus department in 1920 was much greater than in 1919. Close co-operation had been effected with the associated firm of Elliott Bros., whose reputation for certain highly specialised lines was world-wide. Business in telephone exchange apparatus, both automatic and manual, had also grown satisfactorily. For manual exchanges contracts for no less than 14 were obtained during the year from the British Post Office. Four public exchanges were put into satisfactory operation, others were being installed, and the remainder were in an advanced state in the workshops. There was a marked rise in the orders for land-lines in 1920, and with the reduced prices now prevailing a further increase might be expected, as land-lines had developed inadequately during the past few years. In raw materials there had been large fluctuations in prices. At the beginning of the year these prices were on the up grade, but later fell rapidly. No loss was anticipated on purchases of material or stocks in hand. The difficulties of manufacture were accentuated by numerous industrial disputes. Every industry was so dependent on others that a disturbance of normal conditions in one was felt in all others; than which no more calamitous illustration had ever been experienced than the present coal strike. To compete in the world's markets, raw materials must be obtained at reasonable prices. For a long time these prices had been exorbitant, due chiefly to the excessive price of coal, in itself due in the main to the extravagant wages paid to the miners. Coal was the base of practically all British industry, and the evil of the exalted price of fuel swept through every branch of industry. The chairman then moved the adoption of the accounts, which was seconded by Lord Queenborough, and carried.

Subsequently an extraordinary general meeting was held, at which it was agreed to increase the capital by £1,000,000 by the creation of a million 10 per cent. cumulative preference shares of £1 each. Resolutions were also passed respecting an alteration in the articles of association.

British Thomson-Houston Co., Ltd.

The annual meeting was held on May 18th at 83, Cannon Street, E.C. Mr. H. C. Levis, who presided, in alluding to the fact that the company had completed the first quarter century of its existence, said that for many years its growth was very slow, because of the depressed state of the electrical business in this country, and the competition which existed, due not only to the fact that there was no restriction of imports, but also because the manufacturing facilities in the country, when taken in conjunction with the imports, largely exceeded the demand. About 1912, however, matters commenced to improve, and that improvement had been steadily maintained up to nearly the end of the year under review, when a reaction began. Notwithstanding that falling off, the year, as a whole, was a record one, and as a result, the volume of orders on hand on January 1st, 1921, was larger even than on January 1st, 1920, particularly in heavy plant. The depression which began towards the end of last year had continued so far during the present year. It was to be hoped that the present industrial conditions would be so settled in the near future that a revival of trade would take place, and he could not help feeling that such a revival would take place soon after the present strikes were settled, for the reason that the number of important inquiries they were receiving was large, and it was to be assumed that those making the inquiries contemplated making purchases. It must also be remembered that there was a great shortage of electrical machinery which must be made up when prospective purchasers were in a better position to finance their requirements. The issues of shares which he mentioned a year ago had been substantially completed, with the result that the company had outstanding on December 31st last 2,000,000 ordinary shares of the par value of £1 each, and 1,500,000 cumulative preference shares, of a like par value, making the total shares issued £3,500,000. The proceeds were used to liquidate debts, and for other purposes of the company. The debenture stock outstanding amounted to £152,295; £5,300 was retired annually by drawings at 105. The total amount redeemed from the date of issue was £59,705. The loss in exchange, in connection with the amount owing to the International General Electric Co. of New York was almost entirely settled prior to the last annual meeting, and the exchange on the balance of the debt had been so adjusted that no further loss was likely to be incurred. During the year there was expended on factories the large sum of £595,000. That included payment for the factory at Birmingham, which, although purchased in 1919, did not come into their possession until the middle of 1920; also certain additions at their Willesden factory which had considerably increased their manufacturing facilities there. Also further work on the important additions to their Rugby factory, and finally, in connection with new works now being constructed at Chesterfield. Building progress, particularly on the extensions at Rugby, had been painfully slow, due to causes beyond their control, and the relief they anticipated, particularly in relation to the manufacture of heavy plant, had not been fully realised. The total floor space of the various plants of the company amounted to about 1,650,000 square feet. The number of employés at December 31st last was over 9,000. The profits for the year, after deducting all expenses and charges, other than interest on debentures and loans, and after making provision for estimated war taxation for 1920, were £470,470, which showed an increase of nearly £60,000 over 1919. That was realised because of the fact that the amount of unfilled orders on their books at January 1st, 1920, was, up to that time, the largest in the history of the company, and further, that the volume of orders received during the year formed a new record. To that amount of profit must be added the amount brought forward from the previous year. Including £208,431 brought forward, they had the total £678,901 to be dealt with. From that there had to be deducted interest on debentures and loans £179,990; the plant account had been depreciated by £60,000, and a reserve of £150,000 had been made in connection with inventories, &c., leaving to be carried to the balance sheet £288,910. That was subject to adjustment of the reserves made for excess profits duty for 1918, 1919, and 1920, and it was believed that those reserves were ample. Out of that amount it was proposed to pay dividends aggregating £63,019, and to carry to the new account £225,891, which was about £17,000 more than was carried forward last year. Many of their employés having from time to time expressed a desire to become financially interested in the company, the directors had arranged to offer to them savings certificates in multiples of £10, bearing interest at the rate of 7 per cent. per annum, free of income tax, up to 6s. in the £, and with a right of participation in the earnings of the company under certain conditions. They were to be paid for on an instalment plan, which would spread the payments over a period of nearly two years. At any time an employé could apply for repayment, and, on the other hand, the company could pay off the certificates. They were personal to the employé, and not negotiable or assignable. Later on, the company might decide to offer some of its shares to its employés on a deferred-payment basis, but for the present it was felt that those certificates, with a fixed and attractive rate of interest, and with participating privileges, would answer the purpose, and prove to be a sound and attractive savings investment. In conclusion, the chairman bore testimony to the efficient and loyal work done by all of the company's employés.

Lord Carmichael seconded the motion, which was carried unanimously.

West London & Provincial Electric Supply Co., Ltd.

Mr. H. Kahn presided at the annual meeting, held at 14, Ironmonger Lane, E.C., on May 18th. He said that the increase of £321 in the balance was chiefly owing to the fact that the dividend of 8 per cent. on the shares in the Chiswick Co. was ½ per cent. over that of the preceding year. They had £5,202 for distribution, and were paying the dividend on the cumulative preference shares at 6 per cent. for 1920, and arrears of interest on the funding certificates for 1917, 1918, and 1919, and the interest on the funding certificates for 1920, and carrying forward £230. As foretold last year, they had now cleared off the arrears of interest on the funding certificates. The results both at Chiswick and at Aberystwyth had shown improvement, and the number of consumers was steadily increasing. At Aberystwyth they had also made a profit of over £1,200 on installation work. There the sale of current was up by £8,131 to £38,817. The speaker reviewed the accounts in some detail. He thought the results would be considered quite satisfactory, but at the risk of being considered a pessimist, he would express the opinion that the year 1921 would not prove so good for the Chiswick Electricity Supply Corporation, Ltd., as the year just reviewed. During the first quarter of 1921 the cost of fuel had gone up enormously, wages had also increased, and as to what the future might bring in regard to the coal position it was impossible to foretell. Luckily, the Chiswick company was not entirely dependent on coal for the generation of its current either at Chiswick or at Aberystwyth, and that was the only bright feature at the present moment.

Prospectuses.—*Metropolitan Electric Supply Co., Ltd.*—The list was originally intended to close to-morrow in an issue of £500,000 7½ per cent. extension debenture stock 1921 at 95 per cent. It is required to meet the cost of installing plant at the company's main generating station at Willesden to the extent of 20,000 kW, thereby increasing the plant installed to 40,000 kW, together with the necessary boilers and auxiliary plant, and of trunk mains to link up with the generating station at Uxbridge, in order to provide for the large and growing demand for power and light, particularly in the company's western area of supply. The list was actually closed on Monday for town, but applications received from the country by Tuesday morning's post were considered.

General Electric Co., Ltd.—The underwriting was completed some days ago of an issue of £3,500,000 7 per cent. debentures at 93.

Shanghai Electric Construction Co., Ltd.

The accounts for the year ended December, 1920, show a profit of £174,637, compared with £154,567 in 1919. £3,779 was brought forward. There has been put to reserve for renewals £10,000; to reserve for taxation £50,000; and to general reserve £45,000. Two interim dividends, each of 6 per cent., have been paid, absorbing £38,400, and a final dividend of 8 per cent., less income tax (making 20 per cent. for the year) is recommended on the 32,000 shares of the original

capital, requiring £25,600. Since the date of the accounts the share capital has been increased to £400,000, and £80,000 standing to the credit of general reserve account has been capitalised and applied in paying up in full 8,000 new shares of £10 each, which are distributable as a bonus in the ratio of one new share for every four shares held. The new shares do not rank for the final dividend, but will participate in all dividends declared out of current profits. The loss by exchange on subsidiary coinage in 1920 was £65,857, which is equal to 20.58 per cent. on the capital. The ratio of depreciation to gross takings increased during the year, and still shows an unfavourable tendency. The traffics and net receipts for the current year continue to be satisfactory. The incidence of E.P.D. came to an end, so far as this company is concerned, with the period under review, and its removal will offset to a material extent the effect of the less favourable rate of silver exchange. The Municipal Council has authorised the addition of five new trailer cars, bringing the number of the company's passenger vehicles to 194, made up of 90 motors, 90 trailers, and 14 railless cars (of which seven are in course of construction). Negotiations with the Municipal Council for the extension of the traffic system under railless electric traction are continuing. The directors have under consideration ptoposals for a provident fund for the benefit of the European staff in Shanghai.

Oldham, Ashton & Hyde Electric Tramway, Ltd.

Mr. E. Garcke, presiding at the annual meeting on the 25rd inst., said that the receipts had improved, but the expenses had increased to a much larger extent, due to higher wages paid and higher prices of all materials. The speaker referred at some length to the question of the sale of the undertaking. The local authorities gave notice to purchase in May, 1918, but owing to war conditions the arbitration was considerably delayed, and the award was issued last September. Certain points had since been argued in the Courts, and the company early this year appealed against the decision, and the finding being given against them, they decided to accept it, and not to appeal to the House of Lords. The position, therefore, as left by the Court of Appeal, was that they were entitled to £132,641, plus the whole, or part, or nothing of the £2,880—the item referred back to the arbitrator—plus also the taxed costs of the arbitration, less the costs of the appeal, which the company had to pay; and, of course, they were entitled to the value of stores and sundry other assets. Now the local authorities had advanced a claim that inasmuch as the value of the undertaking which they were purchasing was fixed by the arbitrator as at May 1st, 1918, they were entitled to some deduction from the purchase price thus fixed in respect of depreciation of the undertaking since May, 1918, regard being had to the fact that the company had had the benefit, and the obligations, of working the undertaking since that time. The purchasing authorities offered to pay the company £125,000 in settlement, and they said that if the company did not accept their offer they would pay the larger amount without prejudice to their claim for depreciation. The directors had given the matter their serious consideration, and on balance of all the pros and cons they were prepared to advise the shareholders to accept the offer of £125,000, but they thought it right to leave the matter to the decision of the shareholders. The best estimate he could make at the moment was that there would be something like 24s. per share available as return of capital to the shareholders. The ordinary shareholders had had a regular return of about 6 per cent. per annum since the formation of the company, and both they and the holders of the preference shares had the prospect of receiving the return of the whole of their capital, with an appreciable premium, which was a better result than was expected a few years ago. The improved result was entirely due to the fact that the undertaking had been sold at a time when prices were high.

The meeting unanimously resolved to accept the offer of the purchasing authorities.

Dublin & Lucan Electric Railway Co.

Mr. W. J. Hill, chairman, at the annual meeting of this company, said the receipts had largely increased, but the amount shown in the accounts had been made up by including the Government subsidy of £8,000 to meet losses of working. On the expenditure side there was an increase of 24.4 per cent., mainly due to increased cost of labour and coal. As compared with 1913, the expenditure had increased by 184 per cent., while last year's coal bill was £5,357, as against £1,575 in 1913. The balance now available was £1,055, and the payment of preference dividend for one half-year would absorb £475, leaving £580 to be carried forward.

Referring to the railway settlement, Mr. Hill remarked that if the Government withdrew the subsidy from the company without making adequate arrangements for the carrying on of the line, the position would be that they would have to close down the line immediately. The recent reduction of wages affected the company only to the extent of £300 or £400 per annum, and the Transport Ministry had increased passenger and goods rates to an almost prohibitive figure. If a sum of money were to be allocated to Irish railways by the Government, it would be only common justice that the small railways should share in it entirely out of proportion to the share received by the large lines.

Lancashire Dynamo & Motor Co., Ltd.—The annual report shows an increase in the net profits of £6,555, the figures for the past year being £26,492, against £19,937 for 1919. As the directors state, this result is satisfactory having regard to labour troubles and disputes which adversely affected deliveries and cost of materials used. The final dividend recommended on the ordinary shares is 6¼ per cent., making 10 per cent. for the year, tax free (including additional capital). This is the same as for each of the two preceding years, while for 1915, 1916, and 1917 12½ per cent. was paid. It is proposed to transfer £10,000 to reserve for investments and to carry forward £2,444. A year ago £477 was placed to reserve and £5,542 carried forward. The company's liability for E.P.D. from 1917 to 1920 inclusive is still unsettled, but full provision has been made to cover this.—*Manchester Daily Dispatch.*

Potteries Electric Traction Co., Ltd.—Mr. R. J. Howley said at the annual meeting that the results were not as satisfactory as they could have wished; the period under review had been one of the most difficult he could recollect. A further increase of 9s. per week in wages of tramway workers made a total increase of 43s. a week since 1914. During 1920 they paid in wages £147,934, as against £42,933 in 1914. Relatively the cost of power for working the tramways had increased to an even greater extent than the cost of labour, amounting to £31,509, as compared with £7,677. This was mainly due to the higher price of coal, £22,564 in 1920, and £5,318 in 1914. Rates had increased from £6,026 in 1914 to £11,983 in 1920. After referring further to the accounts and to the competition from char-a-bancs, the speaker said that the traffic receipts for the first three months of the current year were satisfactory, but, owing to the coal strike, the number of passengers had fallen considerably.

The Felten & Guilleaume Co.—It is stated that the directors of the Felten & Guilleaume Karlswerke A.G., of Cologne-Mulheim, propose to pay a dividend at the rate of 20 per cent. for 1920, as compared with 15 per cent. in the previous year, and also to repay 50 per cent. of the existing share capital. The amount required for the latter purpose is derived from the premiums realised on the issue of shares last year to the Luxemburg (Terres Rouges) group so as to enable Luxemburg interests to participate in the company.

Buenos Ayres.—The Compania Hispano-Americana de Electricidad, of Madrid, which is the successor of the German Transmarine Electricity Co., of Buenos Ayres and other South American cities, proposes to pay a dividend at the rate of 8 per cent. for 1920 on the share capital of 120,000,000 pesetas. All the promotion expenses, costs of issue, taxes, and stamp taxes have been previously provided for, as well as the payment of 6 per cent. interest on the annuity bonds of nominally 180,000,000 pesetas.

Mirrlees, Bickerton & Day, Ltd.—The accounts for the year ended March, 1921, show, after providing for depreciation and directors' fees, a loss of £9,782. £7,510 was brought forward, so that the adverse balance is £2,272. Substantial sums have been paid in previous years in excess profits, and it is estimated that not less than £20,000 will be recovered by the company under this head, making a credit balance of £17,728. After paying the preference dividend £14,369 is carried forward, no dividend being paid on the ordinary shares.

Babcock & Wilcox, Ltd.—At the annual meeting, last week, Sir John Dewrance said that in spite of the exceedingly difficult times, they had been able to maintain their prosperity. The nation was passing through a very difficult and dangerous period. A large part of their works was closed down for want of coal, and they were unable to obtain steel and other raw materials. The company's organisation and staff was capable of facing any situation which might arise.

Great Northern Telegraph Co., Ltd., of Denmark.—The directors recommend for the year 1920 the distribution of a total dividend and bonus of 24 per cent., including the 5 per cent. already paid, and to transfer £50,000 to the reserve and renewal fund; £83,333 has been allotted to the pension fund. It is further proposed to set aside £416,667 for extraordinary taxes, and to carry forward £285,892 to the account for 1921.

La Plata Electric Tramways Co., Ltd.—After providing for debenture and other interest, the accounts for 1920 show a profit of £6,879, which, added to £10,652 brought in, and after allocating £3,000 to reserve fund, leaves £14,531 to be carried forward, subject to corporation profits tax, if any.—*Financial News.*

Brisbane Electric Tramways Investment Co., Ltd.—A dividend of 4s. per share, free of tax, for the half-year is to be paid on the ordinary shares, making 8 per cent. for the year. £20,000 to reserve, £8,000 to depreciation of investments, and £42,837 carried forward.

Stock Exchange Notice.—The Committee has ordered the undermentioned to be officially quoted:—

Calcutta Electric Supply Corporation.—£500,000 5 per cent. first mortgage convertible (registered) debentures, free of income tax, Nos. 1 to 4,000 (£100) and 4,001 to 6,000 (£50).

Hart Accumulator Co., Ltd.—A dividend of 8 per cent., less tax, on the ordinary shares for the year is recommended. £10,580 is put to income and corporation profits taxes, and £25,616 is to be carried forward.

Altrincham Electric Supply Co., Ltd.—A dividend of 7½ per cent. on the ordinary shares and one of 10s. per share on the deferred are announced.

STOCKS AND SHARES.

TUESDAY EVENING.

THE feature of the Stock Exchange markets is undoubtedly the way in which new issues are being subscribed. Demand for underwriting is eager. There is not enough underwriting to go round. Those in charge of new issues find themselves inundated, in the words of one of them, with requests to be allowed to have a participation in the various offers. It is not that the public take the securities every time on the issue of the prospectuses, although within the past week there have been striking successes scored in this direction. The Metropolitan Electric Supply Company, for instance, which offered 7½ per cent. Extension debenture stock at 95, closed its list soon after midday on Monday, several days in advance of the time to which the prospectus referred as the last day for closing. The Norwegian Government, offering a 6 per cent. loan at 88, was equally successful. A good deal of the money is required by Norway for the development of electrical power. The General Electric Company is about to make an issue of 7 per cent. debenture stock, and in spite of the largeness of the amount required, namely 3½ million pounds, the underwriting was completed rapidly, and some of the people who would have liked a share were shut out altogether, or had to be content with a comparatively small amount.

Although business throughout the general markets is exceedingly quiet, there is no mistaking the appetite of the public for good investments. The depression caused by the continuance of the coal-strike prohibits any attempt at speculation, or any desire to take risks. Consequently, the markets concerned with speculative issues are in a lifeless state. Nevertheless, money accumulates which, in the ordinary way, would be going into trade, and it is this capital which flows so readily nowadays into the good investments either new or old.

The second reading of the Railways Bill will probably be taken this week, and, of course, no particular opposition is expected to be raised at this stage. When the Bill goes into Committee, however, the hostility will develop, and of the big companies, the Great Eastern and the Great Northern chairmen have both declared definitely against the Bill. Some of the other companies, however, are acquiescent in what they perhaps regard as the inevitable, and it remains to be seen whether the changes that are introduced into the Bill will be of sufficiently drastic character to alter its salient features.

Meanwhile the Underground group stands out as being the firmest of any of the railway departments. Underground Incomes have risen 4 to 78½. Anticipation looks for payment of the full £3 per cent. for the half-year ended next March, and some of the optimists hope that the £3 will be paid in September next. The £10 shares are 5s. up at 2½, and the 1s. shares, after touching 8s. 6d., went back a shade, leaving them 1s. higher on the week. Districts are 2½ up. With these, a further improvement has come in London United Tramways preference, the present price of 4s. 6d. comparing with half-a-crown only two or three weeks ago. The company's 4 per cent. debenture has risen from 30 to 35, though as there is scarcely any of it on offer, the latter must be regarded as more or less nominal. London and Suburban Traction preference at 6s. 6d. are another 2s. up, and the ordinary shares are quoted better at 2s. 6d.

Amongst home electricity shares, County of London preference are ¼ better at 8¼, and Metropolitan 4½ per cent. preference at 2 15/16 are an equal amount lower. The decline in the latter occurred, of course, owing to the offer of the Extension debenture stock. The new City of London second preference go quietly ahead, and the premium has advanced to 1s. 6d. It is said that several of the other lighting companies are contemplating new issues in this market, although nothing reliable has yet transpired in regard to such rumours.

The Great Northern Telegraph Company has raised its dividend 2 per cent. to 2½ per cent., and the price is strong at 24. The cable list is better than it looks, owing to the fact that quotations are kept at about their previous levels, but that there is a further shrinkage in the amount of stock available. As an instance, Eastern Telegraph ordinary is called 163½ middle, but it can be sold at 165, while buyers might find it difficult to get any stock at 166. Direct United States have risen to 5⅞ and Anglo-American deferred is harder at 16½. Globe preference advanced to 9½. Amongst the foreign issues, Brazilian Tractions have recovered 2 points to 36. Anglo-Argentine Tramways 5 per cent. debenture stock, mentioned here on several occasions as a sound speculative lock-up when the price was about 55, is 2 points higher this week at 63½. Mexican issues are on the dull side once more, owing to the scarcity of news as to improvement in the outlook for settlement of the companies' finances. Various dollar stocks are better, prices being marked up in accordance with the quotations cabled from New York, although in the matter of actual business, the market is doing next to nothing.

Electrical manufacturing shares are dull on the whole. General Electrics weakened to 22s., on the forthcoming issue of debenture stock. The first preference have fallen to 17s. 6d. and the B shares to 18s. English Electrics are lower at 12s. Siemens' price relaxed to 24s. 4½d. The Chairman, at Monday's meeting, reported that the total value of orders received in 1920 was just over four million pounds sterling, as against £2,835,000 in the previous year. He remarked that, although orders may fall off in some lines, they increase in others, and so the business is balanced. The new shares are quoted 22s. 6d. to 23s.

Armament shares remain under the influence of the coal-strike. Nobel Industries have decided not to pay any dividend on the ordinary shares for 1920, because, although the profits for that year are not less than those of the preceding year, it is considered necessary to conserve resources in every way, and not to make a distribution of profit as would, in normal circumstances, be justified. The shares eased off a trifle on the announcement. Vickers and Armstrongs keep tolerably steady. The rubber share market is no better. A golf ball manufacturer was telling us the other day that, although the price of rubber is under 9½d. per lb., he has to pay 5s. a lb. for his rubber in strips. Marconi shares came on offer at 50s., to rally later on. Canadian Marconi's enjoyed a spurt to 9s. 6d., though ninepence of this was lost on profit-taking by earlier buyers. Radio Common and preferred remain at 9s. 3d. and 11s. respectively.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1919.	Dividend 1920.	Price May 24, 1921.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	12	12	6	—	£10 0 0
Charing Cross Ordinary	7	8	8¼	—	10 6 6
do. do. do. 4½ Pref.	4½	4½	8	—	7 10 6
Chelsea	4	6	8½	—	9 4 8
City of London	13	14	12½	—	11 16 0
do. do. 6 per cent. Pref.	6	6	17/-	—	7 1 2
County of London	8	8	7½	—	10 6 6
do. do. 6 per cent. Pref.	6	6	7½	+ ⅛	7 7 8
Kensington Ordinary	7	9	4½	—	10 18 2
London Electric	2½	2½	1	—	7 10 0
do. do. 6 per cent. Pref.	6	6	2½	—	10 18 2
Metropolitan	6	7	8¾	—	10 7 4
do. 4½ per cent. Pref.	4½	4½	3½	— ⅛	7 13 2
St. James' and Pall Mall	12	12	6	—	10 0 0
South London	6	7	2½	—	9 2 10
South Metropolitan Pref.	7	7	15/9	—	8 17 10
Westminster Ordinary	10	10	6½	—	9 15 2
TELEGRAPHS AND TELEPHONES.	1918	1919			
Anglo-Am. Tel. Pref.	6	6	7⅝	—	7 12 10
do. Def.	88/6	1½	17½	+ ½	9 6 0
Chile Telephone	8	6	5⅜	—	5 6 8
Cuba Sub. Ord.	7	7	7½	—	9 6 8
Eastern Extension	10	10	16⅜	—	6 2 2
Eastern Tel. Ord.	8	10	16⅜	—	6 2 4
Globe Tel. and T. Ord.	8	10	16⅜	—	6 2 2
do. do. Pref.	6	6	9½	+ ½	6 9 9
Great Northern Tel.	22	22	24	—	10 0 0
Indo-European	13	10	23	—	7 16 4
Marconi	25	25	28	—	—
Oriental Telephone Ord.	10	12	2⅜	—	*5 13 0
United R. Plate Tel.	8	8	6¼	—	6 10 8
West India and Panama	1/8	Nil	⅜	—	Nil.
Western Telegraph	8	10	16½	—	*5 19 5
HOME RAILS.	1919	1920			
Central London Ord. Assented	4	4	45½	—	8 15 10
Metropolitan	1½	1½	26¾	+1	5 17 8
do. District	Nil	Nil	19	+2½	Nil
Underground Electric Ordinary	Nil	Nil	9⅜	+ ¼	Nil
do. do. "A"	Nil	Nil	8/-	+1/-	Nil
do. do. Income	4	3	7⅝	+4	2 11 0
FOREIGN TRAMS, &c.	1918	1919			
Anglo-Arg. Trams, First Pref.	Nil	⅝	2⅜	—	10 9
do. do. 2nd Pref.	Nil	Nil	3	—	Nil
do. do. 5 % Deb.	5	5	69½	+1	7 17 6
Brazil Tractions	Nil	Nil	35	+2	Nil
British Columbia Elec. Rly. Pfce.	5	5	55	—	9 1 10
do. do. Preferred	2½	5	53½	—1	*8 15 0
do. do. Deferred	Nil	3	51½	—	*11 17 6
do. do. Deb.	4½	4½	59½	—	7 2 10
Mexico Trams 5 per cent. Bonds	Nil	Nil	42	—	Nil
do. 6 per cent. Bonds	Nil	Nil	23½	—	Nil
Mexican Light Common	Nil	Nil	11¾	—	Nil
do. Pref.	Nil	Nil	17½	— ¼	Nil
do. 1st Bonds	Nil	Nil	69	— ½	Nil
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	9⅞	—	6 11 2
British Aluminium Ord.	10	10	16/3	—	12 6 2
British Insulated Ord.	12½	15	1⅝	—	9 12 0
Callenders	25	15	14	—	10 0 0
„ 6½ Pref.	6½	6½	17/6	—	7 8 7
Crompton Ord.	10	10	16/3	—	12 6 2
Edison-Swan	10	10	11/3	—	—
do. do. 5 per cent. Deb.	5	5	70	—	7 2 10
Electric Construction	10	10	16/3	—	12 6 2
English Electric	—	8	12/-	—1/-	13 6 8
Do. Pref.	—	6	14/6	—	8 5 6
Gen. Elec. Pref.	6½	6½	17/6	—1/6	7 8 7
do. Ord.	10	10	22/-	—1/9	*9 1 10
Henley	25	15	1⅞	—	10 8 8
do. 4½ Pref.	4½	4½	8½	—	6 18 6
India-Rubber	10	10	⅜	—	—
Met.-Vickers Pref.	—	8	14½	—	8 16 10
Siemens Ord.	10	10	1⅞	— ⅛	*8 2 0
Telegraph Con.	20	20	[20½	—	*5 18 4

*Dividends paid free of Income Tax.

THE ROYAL SOCIETY'S SOIRÉE.

(*Concluded from page* 641.)

Prof. K. Onnes, For.Mem.R.S., Sir R. A. Hadfield, F.R.S., and Dr. H. R. Woltjer showed apparatus and specimens used in research on the influence of low temperatures on the magnetic properties of alloys of iron with nickel and manganese. A series of iron-manganese and iron-nickel alloys were exposed to the temperatures of liquid air, liquid hydrogen, and liquid helium respectively, and the specific magnetism tested after the return to atmospheric temperatures. Tests were also made during immersion in liquid hydrogen (− 253 deg. C.), and it was shown that alloys with the higher percentages of manganese cannot be made magnetic even by immersion in liquid helium (− 269 deg. C.). The existence of one magnetic and one non-magnetic manganese-iron compound was shown to be probable.

The National Physical Laboratory had a number of exhibits made up of: (*a*) a relay for breaking moderately large electric currents (Dr. Guy Barr), in which the difficulties due to sparking at the contacts of ordinary relays are avoided by causing the make and break to occur between mercury electrodes in an atmosphere of hydrogen. An iron core floating in mercury carries at its upper end a silica cup, full of mercury, and connections are made to the mercury outside and inside the cup. A solenoid pulls the core and cup down, and thus makes the contact; the current is broken by the core floating up so that the surface of the mercury is cut by the silica, and the spark is sufficiently quenched to allow currents up to 20 amperes at 100 volts to be broken easily. The mercury remains clean.

(*b*) A standard optical pyrometer (Dr. Kay and Dr. Griffiths) designed with a view to facilitating the accurate measurement of high temperatures by the "disappearing filament" method. An image of the hot object is superimposed on the filament of the pyrometer lamp and the brightness matched by varying the current through the lamp. Monochromatic red light is obtained by means of a filter glass in the eyepiece, and to enable the observer to check the permanency of the calibration of the pyrometer, two lamps are fitted which can be interchanged exactly in the field by a simple transverse motion. Each lamp is provided with fine adjustment in three mutually perpendicular planes. The use of the pyrometer for measuring the "black body" temperature of lamp filaments was demonstrated.

(*c*) Various types of hygrometers (Dr. Griffiths and Mr. Schofield) adapted to the measurement of humidity in cold stores.

(*d*) Wireless-telegraphic direction-finding apparatus (Mr. R. L. Smith-Rose) of the type developed by Capt. Robinson, of the Royal Air Force. Instead of finding two positions of a receiving coil for which the signals have equal intensity, two coils at right angles are connected in series and rotated together until the signal strength is unaltered by reversing the connections of one of them. This gives the direction from which the signal is coming and, therefore, the apparent bearing of the transmitting station. Differences between the apparent and the true bearing are found to occur, especially at night; these differences raise many interesting questions in connection with the transmission of electromagnetic waves in wireless telegraphy, and the instruments have been installed at various universities by the Radio Research Board to assist in the elucidation of this problem.

(*e*) Resistance alloy "Omal" for electrical standards (Dr. W. Rosenhain, F.R.S., Mr. S. W. Melsom, and Mr. S. L. Archbutt), a material of the type usually known as "Manganin" which is an alloy of copper, manganese, and nickel. Prior to the war, the product was supplied almost exclusively by Germany, and great difficulty was experienced by makers of scientific and ordinary measuring instruments in obtaining material suitable for their purpose from any other sources. The question was investigated at the Laboratory and, as a result, alloys were made, and watched through the various processes, that meet the requirements as regards temperature co-efficient, constancy, resistivity, and secular change. The material is made in two types, one having a resistivity of 45 microhm-cm., and the other 35 microhm-cm. Samples of the product were shown in various stages of manufacture, in the form of cast ingots, rod, strip, and wire, together with micrographs and curves of the temperature co-efficient.

(*f*) A standard resistance, 0.01 ohm for 200 amperes, (Mr. S. W. Melsom and Mr. H. C. Booth) for the standardisation of current-measuring resistances to the highest degree of accuracy. The element is composed of a number of wires, a method which ensures ease of adjustment, large cooling surface, and uniformity of temperature.

The Western Electric Co., Ltd., exhibited telephone transmission measuring apparatus, including (1) a portable high-frequency bridge designed to give instantaneous readings of the capacity of the cables which are already installed. The cumbersome method of using a galvanometer and batteries, which has heretofore been used, is replaced by a method which gives direct readings of the capacity at any desired frequency. (2) A line impedance high-frequency bridge which enables one to obtain the resistance and reactance components of the line impedance by direct readings. It is an adaptation of the bridge method which is used for measuring effective resistance and effective inductance. (3) A transmission measuring set that gives direct readings of the loss in miles of standard cable of a telephone circuit. (4) A transmission gain measuring set specially developed to determine transmission gains and transmission losses of lines and apparatus used in the telephone art, and (5) a variable frequency oscillator consisting of a thermionic tube generator which is so arranged that the frequency delivered may be varied over the range normally considered essential for voice current. It is arranged to give a uniform output at all frequencies and has a very pure wave form.

The Radiological Branch of the Research Department of the Royal Arsenal at Woolwich had on view a selection of pinhole photographs illustrating the change in shape of the focal spot with current change, and also the various parts of the target of the tube which emit X-rays under varying conditions. The method of protection used when radiographing large metal objects, *i.e.*, complete enclosure in a lead box, was shown by means of photographs, and illustrations could also be seen of a portable set, which has already been described in the engineering Press, that was designed and made in the Research Department at Woolwich for the purpose of the visual examination of materials, and which affords complete protection of the operator.

Dr. Leonard Hill, F.R.S., exhibited his recording kata-thermometer, an instrument which gives a continuous record of the cooling power of the environment exerted on the surface of the bulb of the kata-thermometer which is automatically kept at skin temperature. Introduced into the bulb of the "kata," which is filled with alcohol, is a coil of wire with a large temperature co-efficient of resistance, which coil forms one arm of a Wheatstone bridge that is balanced when the coil is at a temperature of 36.5 deg. C. An automatic device is used by which the current sent through the coil varies according to atmospheric conditions so that the coil is kept at 36.5 deg. C., while an ammeter placed in series with the coil indicates the variations of current and so the cooling power.

Dr. E. E. Fournier d'Albe demonstrated his latest form of optophone, an instrument which enables totally blind people to read ordinary printed books and newspapers. It is based upon the reflection of beams of rapidly intermittent light from the type on to a selenium preparation, which produces sounds in a telephone

varying according to the shapes of the letters. The instrument shown was lent by the National Institute for the Blind, London, where it is in daily use; it has been fully described in our pages.

The instruments and records exhibited by the Meteorological Office included Dr. J. S. Owens's remarkably simple apparatus for recording the degree of atmospheric pollution, and the present lack of coal was clearly indicated on the records. Other interesting records were those which showed the relation between the atmospheric pollution and the vertical potential gradient of atmospheric electricity, which subject is now being investigated at the Kew Observatory.

While the apparatus briefly described above only formed part of the whole shown by some 39 exhibitors, it was noticed that the latter figure had decreased by about one-eighth compared with last year, neither did the exhibition as a whole reach the standard one remembers in pre-war days.

THE PRESENT ECONOMIC POSITION OF THE ENGINEERING AND ALLIED INDUSTRIES.

(*Continued from page* 664.)

The following is a continuation of our extracts from the pamphlet issued by the Engineering Unions:—

The Ruin of Our Foreign Trade.

But although we need say no more about the foreign exchanges, there is an aspect of foreign trade on which we must insist. Why is it that, at a time when there is the most urgent demand for machinery of all kinds, for agricultural implements, for railway locomotives, and what not, the employers are getting so few orders from Germany? They say it is because of the depreciation of the currency, which our employers imagine is so advantageous to employers over there. Assuming this weird idea to be correct, *who is now depreciating still further the German mark*? We understand that an overwhelming majority of the British engineering employers have supported, and still support, Mr. Lloyd George's Government, with its policy of "making Germany pay," and its present proposals of high Customs duties calculated to prevent all German exports. Everything that hinders the German export trade necessarily still further depreciates the German mark; and, therefore (according to the statement of the British engineering employers), *still further strengthens the position of the German employers*. Now, the British employers contend that, because their German competitors enjoy the "advantage" of having a depreciated currency, the British engineering workman must accept lower wages! When the British Government, by its strangling of the German export trade, has caused a further depreciation of the German mark, presumably this extra "advantage" that the German employer will possess will be made the justification for a still further reduction of British wages. . . . Who is paying this so-called German indemnity? The British employers clearly intend that it shall be the British workman.

Of course, this is not what the employers call it. They call it a "consumers' strike."

The Consumers' Strike.

According to the engineering employers, the world was going along very well until "the critical month" of August, 1920—the employers had been, until then, admittedly making large profits, which we have seen reflected in their swollen dividends—but that, suddenly, there was "a consumers' strike," when all over the globe people decided to refuse to buy, because prices were too high. The argument insinuated is that the present depression of trade in engineering products can be remedied by a substantial lowering of price, which will bring the "consumers' strike" to an end, so that purchases will be resumed on the old scale, and employment will once more become brisk.

Unfortunately for this argument, the sequence is the other way. Prices began to fall precipitately long before the so-called "consumers' strike." According to the very figures given in the employers' pamphlet, wholesale prices were at their highest at the end of February, 1920, namely, 256 per cent. above those at the end of December, 1913. They then dropped almost continuously, month by month until, a year later, they stood at no more than 61 per cent. above the 1913 figures. Thus, the wholesale prices, on an average, were, at the end of February, 1921, *less than half* what they had been a year before. If, as it is suggested, a mere cut in prices is sufficient to restore demand, was not this drastic *cutting of prices in halves* enough to bring about a revival of trade? Yet, far from causing demand to increase, and leading to a regular boom, the fall in wholesale prices in the proportion from 356 to 161 was marked, so the employers tell us, not by an increase but by a continuous falling off of orders for commodities, and consequent reduction of work, so that the Trade Union percentage of members drawing unemployment benefit rose from 1.6 per cent. at the end of February, 1920, to 8.5 per cent. at the end of February, 1921.

Whatever was the cause of the slump, it has been demonstrated that a reduction of prices does not remedy it—not even a reduction of prices to the extent of more than half. *This reduction has taken place, and the slump, so the employers tell us, is worse than ever.* The employers, shutting their eyes to this fact, still go on repeating the shibboleth of "reduce prices in order to induce larger sales." Why do they persist in such mistaken political economy? It is because they wish the workmen to come to believe, in their hearts, that it is only by accepting a drastic reduction of wages that they can get rid of unemployment. But every economist knows (though the employers still cannot believe it) that a reduction of wages is no remedy for unemployment.

These countries will not, because they cannot, buy from abroad to a greater total amount than the total amount of their own purchasing power. To offer them British goods at lower prices is merely to give them more British goods for the same total sum—a course which will reduce, not increase, the national advantage from the trade. No general reduction of prices has any effect in increasing the total value of international trade. No general reduction of the cost of production in any country can increase its aggregate share of the trade of the world. British engineering employers may not think much of political economy, except when they want to quote it against the workmen, but it may interest them to remember that, in all their present argument, they are "flying in the face of political economy." For it is the confident teaching of political economy that *no general reduction of prices or wages can, in itself, increase the total value of a nation's exports.*

"General low wages never caused any country to undersell its rivals, nor did general high wages ever hinder it from doing so."

Why Destroy the Home Market?

Not a word is said, from beginning to end of the employers' pamphlet, about the home market. No one would imagine from its perusal that, great as is our interest in the export trade, *two-thirds of the nation's production is for the home consumer.* Even in engineering, which is, along with the cotton trade, exceptionally dependent on export sales, something like 50 per cent. of the whole industry is engaged in producing the locomotive and marine engines, the multifarious equipment of our railways and factories, the innumerable kinds of machines, the agricultural implements, the electrical plant, the scientific instruments, the motor cars, the sewing machines, even the bicycles and gramophones, and all the thousand and one engineering products, for sale and use in the United Kingdom. Large fortunes have been made in the past out of the home trade alone. Even to-day, as is common knowledge, there are engineering firms making quite substantial profits out of one or other kind of engineering for the home market. Why is this left entirely out of account in the employers' pamphlet?

The Conspiracy to Reduce Wages.

This is why the "conspiracy to reduce wages" is worse than a crime; it is an economic blunder. The employers' pamphlet states: "It is unfortunate that, in certain quarters, it should be alleged that employers have entered into a conspiracy having for its object the forcing down of wages. We need not quarrel over the word "conspiracy," or the words "forcing down," which the employers, perhaps, understand in a sense different from that in which they are used by the workmen. But quite a number of prominent employers, in quite a number of different industries, have publicly declared that wages must be reduced, and are to be reduced. At the present moment, to name only half a dozen great industries in which explicit intimations have been made that the associated employers intend and demand a reduction of wages, this is being simultaneously sought by (*a*) the shipbuilding and engineering establishments; (*b*) the cotton and woollen manufacturers; (*c*) the coalowners; (*d*) the farmers on the Agricultural Wage Boards in different parts of the country; (*e*) the mercantile marine; (*f*) as regards the wages of women in particular, the employers in a large proportion of all the Trade Boards. These represent, in the aggregate, at least one-third of the whole wage-earning population of the nation, and there are innumerable other cases in which wages have already been drastically reduced. . . .

Bad Economics.

There is much more false economics in the employers' pamphlet—all deliberately inserted, possibly in all sincerity, with a view to "create atmosphere," and persuade the engineering workman to acquiesce in reductions of wages—but we cannot deal with all the blunders. There is, however, one glaring fallacy directly affecting our own industry which should not be passed over. We are told with all the emphasis of capital letters, that "New capital is the engineer's source of employment. The engineer and the builder are fed and clothed out of the savings of those in other occupations; but those, *e.g.*, the farmers of Northern France and of Russia, have at the moment such a slender margin that they cannot achieve the task which, incidentally, would be enormously to their own advantage. This, to many, may be a new idea, but it is evident that *if people in other industries did not save there could never be an engineering industry at all.*"

This "new idea" is blank nonsense, unworthy even of an

Oxford undergraduate. The engineer and the builder are no more fed and clothed out of other people's savings, or out of savings at all, than any other workmen. They are fed and clothed, year by year, like everyone else, by the contemporary labours of those who produce food and clothing, which are exchanged, at each moment, for the labour of the engineer. . . .

Why Not Give the Facts as to Profits?

It is to be noted that the engineering employers support their argument for a drastic reduction of wages by no facts and no statistics as to the actual results of their enterprises. They imply that these are making no profit whatever now, and that their works are running at a loss. But they do not put the cards on the table. Even without revealing the profit and loss account of particular firms they might, at least, have produced a statement showing (as regards the membership, taken as a whole, of the Engineering Employers and the National Employers' Federations) the total cost of production and the total proceeds of sales, as the mineowners have done. Before the workmen can be expected to believe that the British engineering industry is working at a loss, such an authoritative statement must be published. It is not produced because it does not yet exist. *The employers do not themselves know what their fellow-employers are making.* Only the Inland Revenue officials at Somerset House have any approximation to knowledge on this point; and, to judge from what leaks out privately, supplemented by what is published now and again in joint stock company prospectuses and reports, *there is the greatest possible range of difference between firm and firm.* . . .

It is taken for granted that the employers are to pocket the exceptional profits of good years, but that, in bad years, the workmen are to make good the loss by a lowering of their standard of life. But the very justification for leaving to the employers the exceptional gains of good years is that the employers, in turn, should stand the racket of the bad years. The workman has no share in the gamble, and the wage-earners' standard of life ought to be at all times maintained intact.

The employers' present argument for wage reductions ignores all this; their case is that whatever may have been the state of things down to August, 1920, the flow of new orders has greatly fallen off, lessening of engineering work to be done has already led to extensive discharges, and there is every prospect of a continuance of the slump leading to losses which they have no means of meeting otherwise than by a cut at wages. . . .

No wonder the prices of the shares keep up! From one end of the country to the other engineering firms which find themselves this year making, not losses, but merely less abundant profits than in 1912-14, are sending in their claims for repayment of the Excess Profits Duty that they have parted with during 1915-20. This fact is known to every engineering employer.

Is it quite honest to publish a long pamphlet, insinuating on every page that the employers are making huge losses and have no prospect of avoiding still further losses, except by a drastic cut at wages, without mentioning the fact that practically every engineering firm in the kingdom, which has begun to make losses (or even to find its profits falling below the 1912-14 standard) is already sending its claim for repayment of its Excess Profits Duty? Many tens of thousands of pounds have already been issued by the Treasury to engineering employers during the last few months in such repayments.

In view of these circumstances, the first step must be to put all the cards on the table. Without any revelation of the business of particular firms, there can be no valid objection to the production of an accountant's certificate showing, for each of the past ten years, as regards all the firms associated in the Employers' Federations:—

(*a*) The aggregate cost of production and working;
(*b*) The total net proceeds of sales;
(*c*) The aggregate amount paid to Government as Excess Profits Duty, and the portion of that amount that has already been repaid.
(*d*) The aggregate amount distributed to partners and stockholders of all kinds.

Specific Instances of Foreign Competition.

Although the employers carefully conceal the facts and statistics of their enterprises, on which alone any valid claim for a reduction of wages could be based, their pamphlet abounds in alarmist "hearsay" statements—unauthenticated, obviously unverified by the writer of the pamphlet, and unverifiable by its readers—as to foreign competition. We are presented with as many as six and a-half pages of statements (unsupported by details or statistical proof) as to alleged undercutting by foreign manufacturers and "orders lost to this country." Trade Unionists, whilst fully aware that manufacturers in other countries exist, and that they naturally secure some of the orders that British firms would like (at their own prices) to execute, will not be impressed by these instances. *They have heard them all before.* At every conflict with the employers over wage-rates and conditions, from 1851 down to last year, the same bugbear of foreign competition has been, at every recurring period of "bad trade," trotted out. Exactly similar cases have been cited of British tenders being rejected in favour of those of foreign firms. Almost identical instances have been adduced of orders cancelled, withdrawn, or transferred, and just the same insinuation is made that the only remedy is for the British workman to submit to a reduction of his wages. *Each time, during the past 70 years, subsequent events have shown the scare to have been an illusion.* Within a very few years on each occasion the amount of engineering products exported to other countries has not only gone back to its former height, but has actually greatly increased, and the profits of the successful employers (as revealed in the last few decades by the published prospectuses and balance sheets of their joint stock companies) have grown by leaps and bounds. And now, when those exports have risen to a height surpassing the wildest dreams of the engineering employers of 1851, with an aggregation of profits during the past decade that would have made them gasp and stare, the same old bogey of foreign competition is trotted out, almost in the same words as in the preceding generations!

Such denseness of comprehension and failure to learn from experience is surely somewhat remarkable. It is strange that the employers and their scribes do not realise that, in bewailing the frequency with which, in bad times, they tender in vain, only to find orders going elsewhere, they are merely suffering from an illusion. What is real is the universal but temporary falling off of demand. What is illusion is the impression that our rivals are doing better than ourselves. When trade is good and firms are "booked up" with orders, they do not put in tenders for every job that is advertised. They may, indeed, refuse to tender at all. When, on the contrary, work is slack, they tender on every opportunity for every job they can hear of. If, because business is bad, every engineering firms puts in, this year, four times as many tenders as last year, there must necessarily be four times as many tenders rejected as there were last year, leading every firm, quite sincerely, to believe in four times as many instances of "losing trade by foreign competition," four times as many cases of the "shortsightedness of the workmen in demanding such high wages," four times as many opportunities for demonstrating the "ruin of the British engineering industry"! Yet it would be all illusion due merely to the increased frequency of tendering by all the firms.

As a matter of fact, there is no more "foreign competition" when trade is bad than when it is good. At all times foreign engineering firms exist, and do business in competition with others in their own and foreign countries. Extraordinary as it may seem to simple-minded British employers, we do not find these foreign engineering firms exceptionally busy and prosperous just when British engineering firms are slack and "losing money." On the contrary, experience shows that it is just in the years that British engineering is flourishing, working overtime, and making large profits that our foreign competitors are having the same experience. Equally is it the case that years of slump affect all countries. And there is a reason for this universality. Each country gains by the prosperity of its rivals; and, on the other hand, when bad times come it suffers along with its rivals. Nevertheless, the delusion is, among engineering employers, almost universal. At this very moment, when British engineering firms are telling their workmen that only by a reduction of wages can they cope with the Belgian, German, or American competition, as the case may be, we have information that Belgian, German, and American engineering firms are enforcing on their own workmen reductions of wages and increases of working hours, on the plea that without these they cannot compete with their British competitors and rivals (or Belgian, or German, or American, as the case may be), and in each case the employers are quite honest in their arguments. They are going on, generation after generation, making, through sheer ignorance, the same economic blunders. The answer to their tale of woe is simply, "It is not true."

(*To be continued.*)

Decline of Italian Industry.—The *Economic Review*, quoting from *Economista d'Italia*, states that during the war the Italian engineering industry made such progress that it was able to export even the class of machinery for which Italy had previously been dependent on the foreigner. At present it is passing through a crisis. Several firms are still engaged in the execution of outstanding orders, but as few new ones have come in their activity will be appreciably reduced. Many orders have been lost owing to the successful competition of Germany, Hungary, and Czecho-Slovakia. In a recent tender for electrical plant the prices offered by German firms were a third lower than the Italian offers. The construction of a complete set of paper-making machinery was adjudged to a German firm at M. 2 mill., equivalent to L. 800,000, whereas the lowest Italian tender was L. 1,250,000. The same results have occurred with regard to aviation plant and railway rolling stock.

Patents: Licences of Right.—The *Board of Trade Journal* states that, by virtue of the provisions of Sec. 24 of the Patents and Designs Acts, 1907 and 1919, the undermentioned patents were amongst those endorsed "Licences of Right," on May 11th, 1921:—No. 974, of 1913 (J. G. Johnson, Badische Anilin and Soda Fabrik), "Improvements in and relating to chemical reactions in gases by means of electric arcs." No. 113,523 (3,213, of 1918). (N. V. Fab. van Instrumenten en Electrische Apparaten "Inventum,") "Improvements in electric heating apparatus."

ELECTRICITY SUPPLY TARIFFS.

At an ordinary general meeting of the Institution of Electrical Engineers, held on April 26th, a discussion on "Tariffs" was opened by Messrs. J. R. Blaikie and J. W. Beauchamp, each of whom read a paper. Abstracts of the papers follow:—

Electric Supply: Present Conditions and the Hopkinson Principles.

By J. R. BLAIKIE (*Abstract*).

The paper draws attention to the changes that have come about since the late Dr. John Hopkinson devised the well-known system of dividing the costs of electric supply under two headings, viz., fixed and running charges. At that time electricity was used almost entirely for lighting, and he showed how it might be sold at low rates to compete with gas and still make a profit.

Dr. Hopkinson's concluding sentences were: "It is hopeless to compete with gas in this country all along the line if price is the only consideration. But with selected consumers electricity is cheaper than gas. Surely it is to the interest of those who supply electricity to secure such consumers by charging them a rate having some sort of relation to the cost of supplying them."

It is important to notice the scope and limitations of the problem as thus set forth. There are certain assumptions which have been proved to be thoroughly justified so long as the bulk of the output was for the purpose of lighting, but which do not appear to be applicable, as they stand, to the large undertakings that have since grown up, where lighting constitutes only 10 or 20 per cent. of the output, for example: That the central supply is always ready to supply the maximum demand, which means machines actually running; that all consumers cost the same in wages per kilowatt of demand, and that all consumers cost the same in capital charges per kilowatt of actual demand.

If we divide consumers broadly into two groups, viz., those who require a supply for seven days a week, and those who require a supply for six days a week, we find in the seven-day group: Public lighting, domestic lighting, some heating, a small amount of power and, in certain cases, traction supply; and in the six-day group: Practically all factory power and lighting supply, shop lighting, and some heating.

If we assume that the heating demand in the seven-day group is balanced by the shop lighting in the six-day group and exchanged, the percentage error in the whole group is probably quite trifling in the majority of cases, and the problem is much simplified.

With reference to the Hopkinson assumptions it will be admitted that: In the matter of coal consumption there must be a very considerable difference between the two groups, as the seven-day group not only demands service for more days a week, but also for more hours per day. The factory group is usually limited to, say, 60 hours a week, at definite times; the wages of the seven-day group are much in excess of those for the six-day group, and capital charges are much less per kilowatt in the six-day group for many reasons. The expenditure in mains and services is undoubtedly less, as in the majority of cases low-pressure distributors are entirely eliminated, sub-station space and sometimes buildings are provided by the consumer, and there is an opportunity at the generating station of installing large sets at a lower initial cost per kilowatt.

With these points in mind we can now consider the need of reviewing the whole situation and the possibility of measuring the various differences indicated, with the object of arriving at a satisfactory system of analysis and finally framing tariffs to suit. Since the price of coal has risen so enormously and rates of wages, &c., have increased, we find a remarkable change in the relative values of the components of the fixed charge.

In a comparative study of fixed charges as given for Hopkinson's hypothetical station, for an actual case 1914-15 and for an actual case 1919-20, we get the following percentages: Coal, 21, 23, and 32; other charges, 22, 37, and 42; and capital charges, 57, 40, and 26.

So long as the capital charges were the dominating component of the fixed charge, the assumption that all consumers called for an equal readiness on the part of the undertakers to supply did not make an important difference. Now that coal and wages predominate, the differences between classes of consumers with reference to readiness to supply becomes very important, and it is this feature that we have to watch carefully in trying to hold our own against the possibility of private plants in large factories. The fear of gas competition in lighting disappeared with the introduction of the metal-filament lamp.

If the central supply does not take full credit for the saving due to limited hours of demand, the margin of profit will become very narrow indeed at competitive rates. In coal consumption, the superior running economy of the central supply suffers a discount in mains and transformer losses. In other charges a factory can often claim as good figures as the central supply, particularly where a fair number of engineering hands are employed. In capital charges it is doubtful if the factory cannot do as well, and it must not be forgotten that the central supply is always handicapped with the cost of mains and transformers.

Taking all these points into account the factory load is a serious problem and justifies careful consideration in order that the supply department may feel sure of its ground in offering sufficiently low rates to consolidate the business, and work profitably at the same time.

To go a step further, there are, I believe, many engineers who find it very difficult to decide how the inevitable increases are to be applied. There is a general feeling that they should be applied to the lighting, one of the most effective reasons being that power contracts are very difficult to alter. On the other hand, municipal bodies are apt to favour the taxation of the power consumer.

From conditions as they are to-day it is possible to retrace our steps and start again, following Dr. Hopkinson's methods, with new facts, new observations, and changed conditions. We have before us still the brilliant idea of grouping and selecting consumers, and dividing the costs between them in such a manner that we may safely quote low rates to certain classes.

Having stated the need and indicated the advantages of regarding consumers under the two headings of six and seven days, the problem arises as to how the costs can be segregated.

Beginning with coal we can follow Dr. Hopkinson and take a hypothetical station running under average conditions. Let us assume that the plant consists of four sets of turbo-generators, each of 1,000 kW, three being in service at a time to meet demands as follows: For lighting, 800 kW, and for power 1,600 kW; total, 2,400 kW. If the lighting load factor is 12½ per cent. the output per annum is 876,000 units, and if the power load factor is 23.7 per cent., 3,324,000 units, a total of 4,200,000 units; the whole station load factor will thus be 20 per cent.

If the total observed coal consumption is 6 lb. per unit sold, and the running coal 2.5 lb. per unit sold, then the total coal consumed will be 11,200 tons, which we will now apportion to the two supplies: Running coal units × 2.5 lb:—Power 3,700, lighting 980; total 4,680 tons. Fixed coal: kW × 2.72 tons per annum:—Power 4,350, lighting 2,170; total 6,520 tons. This gives the following totals:—Power 8,050, lighting, 3,150; grand total 11,200 tons, or expressed as lb. per unit sold 5.43, 8.05, and 6 respectively.

The total capacity of the system in kilowatt-hours may be:—One 1,000-kW for 8,760 hours, 8,760,000; one 1,000-kW for 51 weeks of 60 hours, 3,060,000, and one 1,000-kW for 25 weeks of 6 hours, 150,000; total, 11,970,000 kWh. For running this number of plant kWh without generating any current we have already allocated 6,520 tons as fixed coal, or 1.22 lb. per plant kWh run.

For comparative purposes between one station and another or between one year and another of the same plant, it is the percentage of units output to the plant kWh run that is needed. In this case it is about 35 per cent., though the ordinary load-factor scale shows 20 per cent.

To continue with our hypothetical station. If power alone were required two sets would run 51 weeks of 60 hours. Lighting alone would require one set for 8,760 hours, a total of 14,880,000 kWh.

But by the co-operation of the two supplies we have seen that only 11,970,000 plant kWh run are necessary, or about 19.6 per cent. less. We can therefore reduce each of the above items by 19.6 per cent.

In the probable working of the hypothetical station the percentages of output to plant kWh run in the two groups are:—Lighting 12½ per cent. and usual load factor 12½ per cent.; power 67½ per cent. and usual load factor 23.7 per cent.

It follows, therefore, in the six-day group that beyond a load factor of about 35 per cent. on the usual scale we cannot expect a further reduction in coal consumption for power, as at this load factor the plant would be running at 100 per cent. activity on the plant kWh scale.

Any further increase in output could only be obtained by increasing the number of plant kWh. The coal per unit could only be decreased beyond this point by employing more efficient plant.

Through the courtesy of the several engineers concerned, the author has been able to examine and experiment with the figures of several undertakings, and the results obtained confirm his figures for the plant kWh scale of the hypothetical case.

It was suggested by Dr. Hopkinson that the running charge should contain, besides the running coal, certain proportions of wages and stores. Mr. Arthur Wright and others have shown this method to be very satisfactory for a number of years, but, incidentally, always on a rising load factor. If for some reason, such as "summer time" or shorter factory hours, the load factor drops, it is difficult to believe that there will be any reduction in expenditure except on account of coal. It is suggested, therefore, that the safest policy is to limit the running charge to coal only.

A method of finding the fixed coal has already been described. The two other components of the fixed charges, viz., capital charges and all other charges, can be divided and

allocated to the two groups by simultaneous equations, as in the case of the coal. In these cases, of course, "kilowatts demanded" are substituted for "units," and values are found for each group per kilowatt demanded.

Examples from the actual figures are given in the paper.

From these figures it is seen that the cost of private lighting is about 4½ times the cost of power, and the cost of public lighting about twice the cost of power, with low-priced coal.

There are two views of charging held: The value-of-service theory, and the cost-of-service theory.

The first simply means getting as much as possible having regard to the possibility of competition. The second is a rate which includes a comfortable return on capital, and is found to be very palatable to public utility commissioners.

An extreme case of the value-of-service theory is found in a scheme which is in successful operation in a few undertakings, known as the "Point Five" system. It is a compound charge which has no sort of relation to the cost of supply; the fixed charge is based upon the rateable value of the property, and current is supplied at ½d. per unit.

For those who feel constrained to supply on the cost-of-service theory, as public policy, the following methods can be applied: The Hopkinson compound rate and variations; the Wright maximum demand system; the Doherty system (American) which is a three-charge rate similar to the Hopkinson, the third rate being a consumer's charge to cover book-keeping, meter reading, and such charges that are common to every consumer, large or small; and various time-controlled two-rate meters.

None of these systems, however, defines what the cost really is.

Dr. Hopkinson's discovery that the costs of preparation were very high and that the costs of continuing to supply were very low, naturally suggests that the first charge should be high and the second low. This form of tariff may encourage waste at the high rate in order to attain the low one, and at the low rate because it is not worth the trouble of economising. Proposals to dispense with meters altogether are an encouragement to waste, and are against national interests. In the opinion of the author, the value-of-service theory is the only one of practical value, and the aim of the management should be substantial profits, with an eye to future competition. In the case of public authorities these profits can be applied to various reserve funds or to the relief of the rates.

Returning to the form of analysis proposed, it remains to show the practical application of one form of tariff dealing with the points that arise.

Having divided the supply into suitable groups, there is no reason why the usual load-factor differentiation should not apply to each group, as far as is legally and commercially practicable.

In addition, a coal clause should be devised to adjust automatically the rates of charge with the price of coal.

For the coal in the fixed charges an opportunity occurs to compensate also for rises in wages and the increasing price of plant and capital. It will be generally admitted that these costs must follow, more or less, the price of coal.

It is, therefore, possible to arrange what may be called a fixed-charge clause as well as a coal clause, both varying automatically with the price of coal.

Power.—In order to compete successfully with private plant, and to meet the changing conditions of hours of labour, it seems essential that all power consumers (six-day group) should be strictly on a load-factor tariff. At the same time, in the author's opinion, a suitable maximum charge should be fixed in order to keep the operation within the limits of fair trading.

As a first approximation the cooking and heating section has so far been included with the six-day group, and in justification it may be pointed out that it possesses in a marked degree many of the characteristics of the large six-day consumers.

There are mains problems to be taken into account, but actual practice may show that in many cases the cooking load will not overlap the heavy lighting load.

Promiscuous heating naturally occurs during the winter months, and is also confined to definite periods. The same arguments apply as in the case of cooking, the only difference being that, whereas cooking loads occur at definite times during each day throughout the year, heating occurs at more irregular times, but only for about half the year.

The lighting of factories where the supply is high-pressure only and limited to factory hours, may be treated as power load. It tends to lower the load factor of the factory and draws extra payment in this way.

As regards the seven-day group, if power is used on Sundays it will probably have a very good load factor on the usual scale, and therefore the price will not be unreasonably high. If there is a considerable Sunday load the analysis will show no very marked difference between the fixed charges of the two groups.

Frequent reference has been made to the relation between units output and what has been called plant kilowatt-hours. It might be expressed as a percentage and is in need of a name. Until a better one is forthcoming the author suggests "work factor." For all statistics connecting coal and units it is essential to know this factor. Comparisons between different undertakings on thermal efficiency are useless without this factor for correction, and, very possibly, a few more factors. We have seen that the consumption of the same plant with the same load factor can vary from about 12 lb. to 8 lb. or less, for no other reason than the development of power load, which has a high "work factor" and therefore improves the average.

On the whole supply the effect of improved plant can be measured by correcting the work factor, and gives a useful indication when it is necessary to balance capital expenditure with improved fuel consumption.

Load factor, as we have seen, is by no means the whole case. Comparatively small stations situated in districts with a load factor of about 30 per cent., but with a high "work factor," might easily be more efficient than a super-power station. With the large amount of data collected day by day in the larger undertakings, there should be as much scope for special and continuous research as there is for a chemist in a steelworks. Continuous checking and testing of the tariffs are as important as watching the cost of generation. Occasions arise when the timely correction of properly measured amounts may easily be worth ten times the saving due to the best engine-room and boiler-house supervision. It should never be forgotten that practically all tariffs are based on certain assumptions, liable to vary with every new development. It may be the expansion of some particular service, the price of coal, factory hours of labour, or a gradual change of power factor.

(To be continued.)

JOINT ELECTRICITY AUTHORITIES.

The West Riding Inquiry.

An inquiry on which hinges the future of electricity supply and distribution in the greater part of the West Riding of Yorkshire was opened in the Leeds Town Hall on Wednesday last week by the Electricity Commissioners.

The local authorities concerned have been unable to agree on a joint scheme, the main item of discord being the inclusion or exclusion in its present state and capacity of the Yorkshire Electric Power Co., which already supplies a large area in the West Riding. The result is the projection of three separate schemes, one by the Leeds Corporation, providing for the co-operation of the Power Co. for 42 years, and its purchase at any time after the expiration of that period; the second by a conference of local authorities in which Bradford is the central figure, providing for the immediate absorption of the Power Co.; and the third by the Power Co. itself, which suggests the company as the future Joint Electricity Authority in embryo, the municipalities to become joint controllers by the purchase of shares.

The Commission was composed of Sir John Snell (chairman), Sir Harry Haward, Mr. H. Booth, and Mr. A. Page, with Mr. E. W. Hudson as legal adviser and Mr. D. S. Cumberlege as clerk. Mr. E. Woolf, of Liverpool, represented the Leeds Corporation; Mr. A. T. Miller, K.C., and Mr. T. R. D. Wright, the conference of local authorities; Mr. J. Hunter Gray, K.C., and Mr. R. A. Shepherd, the Yorkshire Electric Power Co.; Mr. J. C. McGrath, the West Riding County Council; and Mr. J. A. Greene, the West Riding District Councils' Association. Affected railways and other bodies were also represented.

In an explanatory address occupying nearly two hours, Mr. Woolf put forward the Leeds scheme. He emphasised the care taken in the compilation of it, and deplored the lack of outside support accorded to it. For the latter, he said, there were various reasons, but the primary ones were undoubtedly the questions of principle of representation and the unsatisfactory and almost chaotic condition of legislation at the present time with reference to those matters. His clients had been much impressed by the cogency of the various representations of the committees instituted by the Government in recent years, both with regard to the conservation of coal and the improvement of electricity supply. But with the imperfections of the Statute of 1919 they found themselves left with the necessity for the development of electrical re-organisation and without any powers of compulsion with reference to the acquisition of electrical undertakings, and without any genuine or satisfactory financial endowment. This had induced two results—the attitude of those who said that the Act was so imperfect and the situation so chaotic that one must do nothing, but must acquiesce in what was virtually stereotyping, if not paralysing, electrical development, and the other the category of those who said that these statutory defects and inadequacies would be supplemented at an early date, and schemes could be put forward in the confidence that powers for coercion and financial endowment would be available.

Leeds did not desire to be identified with either of those categories, neither sharing the apathy of those who believed that the present position involved essential futility, nor the precipitancy of those who were anxious to run before they had the power to walk. Its attitude had not been one of selfish exclusiveness. Counsel traced the local developments in the matter before the Act of 1919, the conferences between the local authorities after the passing of the Act, and the reasons for the retirement of Leeds from the deliberations of the conference. Since then, he said, the residue of the local authorities had gone on with their scheme, and Leeds had been compelled reluctantly to plough a lonely furrow, but a furrow

which they hoped even yet might produce a useful electrical harvest. The scheme was put forward as one which must supply invaluable data and material, and which might well, after the defects and impossibilities of the Bradford scheme had been more thoroughly exposed and more genuinely appreciated, even evoke the support of those who at present were behind and in apparent sympathy with other schemes.

In the drafting of the scheme they had carefully limited themselves, apart from finance.* They had not invoked the assistance of any powers with which the legislature did not provide them. They did not wish to talk of compulsion or coercion when they had no powers of compulsion. They wanted to see how far their scheme, which was well within the four corners of the Statute, could be seriously regarded as a contribution to electrical economy and efficiency. Its general objects might be summarised conveniently under four heads:—

1. To encourage efficient autonomy. Under their scheme the heads of great undertakings had the same impulse and the same incentive to develop their own electricity supply, and to surpass their own past records in efficiency.

2. What might be called the main object, to enlist the co-operation of the Yorkshire Electric Power Co. They regarded the Power Co. as not only an inevitable but an invaluable factor in the electrical life of the area.

3. They wanted to avoid large and impossible capital commitments.

4. They most particularly desired to avoid the generation of friction, and to concentrate on the generation of electricity.

As for the area of the scheme, Leeds, like Bradford, had adopted that prescribed by the Commissioners, as suitable, and of convenient size. In that area there was a population of 2,114,000, of which Leeds accommodated 445,550, say, one-fifth. Leeds was also responsible for the generation of about 30 per cent. of the total electricity generated in the area in 1920. One peculiar feature of the electrical position in the area, which was almost unique, was that by 1935 there would be remarkably little difference in the situation, financial or electrical, either under any of the schemes or under independent evolution. It was not a practical electrical proposition to erect one super-station owing to the difficulty of finding adequate cooling resources within reasonable distance. That being so—and it was conceded in other schemes—whatever the scheme adopted there would only be moderate-sized stations, and, again, under any scheme, these would probably be three in number.

The scheme of representation on the controlling board provided for five members for Leeds, four for the Yorkshire Electrical Power Co., three for Bradford, and one each for Halifax and Huddersfield, with five for other authorities, and two for the West Riding County Council. The clause providing for the purchase of the Power Co. after 42 years indicated a minimum period during which it would not be absorbed, and gave ample opportunity for legislative changes. He admitted that the whole of that clause was *ultra vires* at present, but it served to show the attitude of Leeds towards the company. No negotiations had taken place between Leeds and the company on that clause so far.

Counsel also dwelt on some of the more important technical clauses, and on the suggested sites in the following suggested order of erection: Leeds, Wakefield, and Knottingley; and, in conclusion, said he did not propose to indulge in any criticism of the Bradford scheme. They had tried, but failed, to co-operate loyally. The Bradford scheme would have to stand—if it ever became a scheme—on support which did not include that of the dominant electrical factor in the area. To his mind, that was a fatal criticism, and when the consequences of it were appreciated by Bradford, and the bodies supporting it, some of them might wish to rally to a scheme which held within it a larger promise of co-operation and success.

The first witness called was Mr. C. N. Hefford, chief engineer and manager of the electricity supply department of the Leeds Corporation, who explained his working basis in arriving at the estimates of cost and output up to 1935.

On Thursday, Mr. Hefford again went into the witness-box. He had been under cross-examination since about noon on the previous day, and before he was released, completed a full day of the ordeal.

Mr. A. T. Miller, for the Conference of Local Authorities, opened the day's session, and elicited the information from Mr. Hefford that it was proposed in the Leeds scheme to erect a central distributing station at Morley, from which transmission cables would run, untapped, to sub-stations. In his opinion, the danger of failure of supply from tapping *en route* was so great as to justify further expense in laying a double set of cables. He admitted that this would lay them open to the possibility of the control engineer at Morley working the sub-stations unfavourably in relation to each other, but said the same thing might happen in any single generating station.

The witness agreed with Mr. J. Hunter Gray, K.C. (for the Yorkshire Electric Power Co.), that the company could supply the requirements of the area as efficiently as the new scheme, and that the cost of providing such a scheme by the company would be borne by the company itself.

Under the Leeds scheme, until you have legislation to enable the authority to get the finances, the scheme is impossible?—Yes.

The witness, answering further questions, admitted that the whole scheme was dependent on the agreement of the Power Co.

The Chairman (Sir John Snell): Do you not think the double system of transmission lines you contemplate will mean an unnecessary expenditure on the transmission system?—I don't.

You are of opinion that there will be no unnecessary expenditure of capital involved by the creation of a system of high-pressure transmission lines by the joint authority and of a secondary system of lower pressure, but still high pressure, transmission lines by the Power Co. or someone else?—That is so.

Is it your opinion that whatever the scheme adopted for this particular area the extra-high-pressure transmission lines will be necessary in addition to the secondary high-pressure transmission lines of the Power Co. or someone else?—It is.

Your point is that the protection of these important arteries is better carried out if they remain untapped from source to point of supply?—Most certainly.

Mr. Page: Is not that point dealt with by retaining one or possibly two untapped lines between such stations and using the others for the ordinary purposes of distribution *en route*?—I admit that is quite possible.

Would you advise it in your scheme?—I should not advise it. I don't like it at all.

Mr. Hunter Gray: I think you said earlier that you don't intend to supply and distribute. You would only supply to the secondary stations, which would themselves distribute?—That is so.

Yet in Section 29 of the scheme you have the power to distribute yourselves?—That is in districts where there is no supply.

It is put to me that there is no district without a supply?—That I cannot say.

Mr. Hefford, in answer to further questions, conceded that there was no engineering reason why the Power Co. should not do the work suggested, that the company's policy had never been an obstructive one, business negotiations had been amicable, and that it had expressed willingness to enter into working agreements with the Leeds Corporation.

Mr. J. A. Greene, for neighbouring small bodies, concerned himself particularly with the finance of the scheme. Did it not provide, he asked, that Leeds would get a capital station without paying any of the expense of creating it?

The Witness: It provides first for assistance by grant.

And it is quite clear to the Corporation that there will be no contribution from the ratepayers of Leeds at all?—Unless there is a deficit.

But surely a deficit would be met from the Exchequer? The capital expenditure on your Leeds station would be met by the Joint Electricity Authority, and not by the Leeds Corporation, although it would in effect supply the consumers within the city of Leeds?—Certainly.

Suppose there was no Joint Authority, in the interests of the city of Leeds would you have to have that capital station?—Yes.

And in that case who would pay for it? It would be met by loan in the ordinary way?—Certainly.

That might lead to an increase of rates?—It might.

But under this system there could be no increase in the rates, could there?—No.

The witness further agreed that there might be friction between the Joint Authority and Leeds itself, but thought Leeds would adopt any policy which was for the good of the area.

The Chairman: Your proposal does not in any way interfere with the distribution in any local government area?—That is so.

Mr. Greene: Do you expect as a result of this scheme that the price of electricity will be decreased?—I do.

Mr. J. C. McGrath, for the West Riding County Council, took up Mr. Hefford on that point, and both entered into much detail as to bases of calculations and estimates applying to future years, the estimates showing a saving on the scheme that would not be effected in the ordinary course of independent evolution of existing stations.

Mr. McGrath: At any rate, your scheme is entirely dependent on State aid? If that is not forthcoming the scheme falls to the ground?—If the money is not forthcoming, yes.

I suggest that it is a particularly bad time to enter upon any public scheme involving the outlay of large capital sums. Do you agree?—Yes, I do.

Will you agree that the economic conditions are extremely unfavourable?—Quite.

The Chairman pointed out that on the estimates the scheme would expend less money than would go in individual development of existing stations, for some years, at any rate.

Mr. McGrath: I suggest to you that the proposal is a very serious mistake, and that the proper thing to do would be to have trunk inter-connecting mains running from the capital power stations to the towns proposed to be served. I suggest that to centralise the whole thing at this point is not advisable?—I don't agree.

Mr. Hefford was also cross-examined for the Yorkshire Woollen District Electrical Tramways, Ltd., and was then re-examined by Mr. Wooll.

Sir Robert Fox, town clerk of Leeds, followed Mr. Hefford.

* See Electrical Review, June 25th, 1921, p. 815.

On the question of the constitution of the controlling authority, he said it was not thought desirable to have a large governing body. Cross-examined by Mr. Miller, he said the Leeds Corporation had come to the conclusion that so far as Leeds was concerned they could arrive at the same ultimate position without any Joint Authority.

But that would involve expense for Leeds?—Quite so.

Leeds will take no financial responsibility?—That is so.

I suggest that that is not a very fair position for Leeds to take up. They will want electricity just as much as anyone else in the future, will they not?—Certainly they will. They will take their fair share. At present, the witness added, Leeds could supply itself with electricity without any danger of its falling on the rates. They had been asked to take part in combating national waste, and they considered that if they were to do that and to help other places to do it, they were quite justified in saying there ought to be no call upon the rates of Leeds in doing so.

On the resumption of the inquiry, on May 20th, Sir Robert Fox denied that Leeds Corporation contemplated any preferential advantage to the city by its scheme; any advantage which might accrue from successful application for State subsidy would be enjoyed equally by all concerned, and any disadvantage which might result from the extinction, by gradual atrophy, of existing undertakings was not confined to the undertaking of the Yorkshire Electric Power Co.

Sir Harry Haward questioned the witness as to whether he considered reasonable the fact—which he had admitted—that there was a certain element of double representation given in the settlement of the amount of electricity supplied in districts which were served by companies; under the Leeds scheme the companies would have representation and also the local authorities of the districts in which the companies operated.

The Witness agreed that there might be a little objection to that, but fancied that any remedy might prove worse than the disease. He agreed that it did not follow that the local authorities of the districts were entitled to equal representation with the local authorities which were authorised to undertake; but it had been a convenient way of constituting a sufficiently small board to be workable.

Sir Harry Haward: Is it not rather an unusual method of constituting a Joint Authority, where you are providing for representation of different interests, to pool the voting? By a combination of certain of the voting parties those parties might elect the whole of the members of the authority.—I must arrive at some basis on which to constitute representation. The basis really applicable is that of consumption of electricity and the statutory requirement of representation of those who would provide the electricity. I suggest they should all have equal voting power because the one common and leading factor is consumption of energy.

Sir Harry Haward: It seems to me that by pooling the votes and providing no definite representation of the two classes of local authorities and companies, you stand a chance of a particular combination getting entire control of the Joint Authority.—It opens the possibility, but I am prepared to take the risk. I cannot think a public-minded body would be open to a resort of that kind. Further, you would be open to that risk on any kind of constituted Joint Authority, and I don't think anything can debar the possibility of such methods of election. Sir Robert added that he would be prepared to amend the Leeds scheme in the direction of providing for definite representation until further order, giving Leeds five representatives, the Power Co. four, Bradford three, and the other authorities voting as a class.

Counsel for a railway company suggested that the amendment proposed would involve abandonment of the Leeds general principles.—Witness said it would obviously follow that there ought to be a provision that in any future revision of the scheme relative consumption would be the main factor.

The Chairman (Sir John Snell), commenting on the essential differences of attitude towards the Power Co.'s continuance or otherwise, as between the Leeds and Conference schemes, asked Sir Robert if he had had any negotiations with the company which he was at liberty to divulge, with regard to subsequent acquisition.—Witness said he had only had negotiations with the company with regard to a suggested working agreement. Asked whether he had any definite objection to the continuance of private enterprise, provided that it could be done efficiently in conjunction with existing plant and without involving local authorities in the heavy expense contemplated, the witness said he could not say that the view of Leeds Corporation had been expressed in that precise form, but its general attitude raised no objection whatever to private enterprise; it very much appreciated what private enterprise was doing, but in arriving at its conclusions it had had in mind the fact that whatever its point of view might be it had no power to do otherwise except with the consent of the Power Co. to be merged, which had never been anticipated as being likely to be obtained. It understood that there could not be public control unless the company was prepared to give up private enterprise on terms satisfactory to itself.

Is it the opinion of your Council that the object would be gained in the promotion of the best scheme, whether public or private?—Undoubtedly; it is purely a matter of business, and not of sentiment or politics.

Mr. Arthur Collins, city treasurer of Birmingham, gave evidence as a financial expert, on behalf of the Leeds scheme. In answer to Mr. Wooll, he said he had been consulted in connection with the financial side of joint electricity and other schemes up and down the country, and he wished it to be understood that his views related entirely to the West Riding situation, with its own peculiarities, and were not of general application. Leeds held a predominating position in this matter, not merely from the standpoint of responsibility for capital provision, but the actual incidence of expenditure, whether it should be borne by ratepayers or by consumers generally. The figures of connections in 1914 showed 36,000 kW for Leeds, as against 25,000 for Bradford, the next biggest, and the Leeds dominance was maintained throughout the years up to and including 1920 (as near the present as was ascertainable), when the Leeds connections were 81,000 and Bradford 55,000 kW. He had no definite statistics of the Yorkshire Power Co., but he understood the 1920 figure was about 29,000 kW.

Mr. Hunter Gray, for the Power Co., said the figures for that authority were: 1914, 30,100, increasing to 62,600 in 1920, so that the company came second and Bradford third.—Witness accepted the figures, though he expressed surprise to learn that Bradford, apparently, as leader of the Conference, was proposing to buy out an undertaking bigger than itself. The figures given meant that since 1914 there had been approximate increases of 125 per cent. for Leeds, 111½ per cent. for Bradford, and 110 per cent. for the company, despite the retarding influences of wartime. There certainly had been a striking electrical development in the area. For the future Leeds was estimating a demand for 79,000 kW in 1931 and Bradford one for 62,000 kW. As measured by energy sent out Leeds, as amended by the engineer, anticipated in 1931 a supply of 190 million kWh, and Bradford 140 million. He was sorry he had no corresponding estimates of the Power Co. The witness emphasised the fact that Leeds alone was doing practically as well as anybody on the present conditions as measured by cost. During the year ended March, 1920, Leeds was able to deliver coal into the generating station at an average price of 25s. 8d. per ton, which was cheaper than any other station whose figures had been given, and the cost of generation was only 0.733d. per unit, the lowest cost figures of any given; Bradford's, the next lowest, was 0.867d. The coal cost in Leeds had been 0.509d., considerably lower than most others, and Bradford's was 0.529d. Those facts, witness suggested, lent strong support to the Leeds view that it was going a long way for the general good, and should not be called upon to pledge its rates. It had been said in evidence that Leeds was in about the same position whether acting alone or in the scheme, but as a matter of fact, it was slightly worse off financially under the scheme than if it carried on alone.

(To be continued.)

A Heart-breaking Appeal.—The supply manager who received, and has sent us, the following piteous appeal must be truly hard-hearted if he turns a blind eye to it. Even if he be so callous as to ignore the moral suasion, he must give way before the dire threat contained in the third paragraph of this extremely cogent letter:—

MOST IMPORTANT.

"Confectioner's Shop," 19, —— Street.
March 31st, 1921.

The Manager,
Electric Works.

Dear Sir, I Happen to live at the above address, and have A place of Business for which I find Rent and Rates are very heavy *and* I open my Shop all day on A Wednesday Every Week. There is no Half Holiday in my Business. And last night I was Without Light or Fire for A very Long Time, I have no Fire for any purpose Except Electric Light.

How Would you feel if you had been in my place Last Night. The pressure has been very poor for Heating purposes for A good While *and* Seeing how things are *Even now* Do you propose to Extend and Try to supply Electric Light and Heat for the new Houses on The Estate before you have Some means of giving A Better Supply to your present Customers. Just Think these matters over please, *and* I hope you will endeavour to let us have A Better Supply of Electricity and A Reliable Continuity, before you *attempt* to Supply a New lot of houses. If the Supply is So Feeble Now and Apt to Fail entirely What Would happen if you had more Customers to Supply. Please Try to prevent us being in the Dark in the Shop in Business Hours *and* Please Do Not Let us Freeze for Want of Electricity.

I Hope you Can Manage at all times to let us have enough Electricity To Boil The Kettle. If *not* You may expect us to Come to Your house to Warm our Selves, See A Light *and* have A Cup of Warm Tea. There are Five of us here, and So your Family would be A Little Larger if we all come. And So For your Own Comfort Sake Perhaps you will Try Your Best To Comfort us with A good *and Constant* Supply of Electricity and oblige

Yours Respy.,
Mrs. L.

P.S.—There is plenty of Electricity in the Atmosphere. Get it and Send us plenty please *and* As Soon as you can Let us have it Cheaper Than it is. God will *not* Charge you anything at all for the Supply.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEXTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

13,094. "Electric arc welding." C. Hardy. May 9th.
13,117. "Electro-magnetic apparatus for recording sound." A. F. Sykes. May 9th.
13,173. "Braking direct-current series motors with recuperation of energy." G. Meyrarth and Soc. Anon. des Ateliers de Secheron. May 9th. (Switzerland, August 18th, 1920.)
13,181. "Flux for welding or depositing metals electrically." J. R. Boser and District Chemical Co., Ltd. May 9th.
13,182. "Generation of continuous waves for wireless telegraphy and telephony." A. Blondel and M. Touly. May 9th.
13,192. "Apparatus for production of electrolytic compounds and their employment." J. T. Niblett. May 10th.
13,202. "Electric lighting or illumination." A. Bell. May 10th.
13,224. "Means for adjustably fixing and retaining magnetos, &c., on bracket." J. B. Brown. May 10th.
13,231. "Trolley-guiding device for electric tramcars, &c." G. A. Lister. May 10th.
13,232. "Electric switches for motor-vehicles, &c." G. A. Lister. May 10th.
13,245. "Windings of alternating current machinery." British Thomson-Houston Co., Ltd., and H. W. Taylor. May 10th.
13,255. "Electric locomotives." E. C. R. Marks (Soc. Anon. Constructions Electriques de Belgique). May 10th.
13,266. "High-frequency multiplex signalling system." Western Electric Co., Ltd. (Western Electric Co., Inc.). May 10th.
13,270. "Apparatus for cancelling electrical signals." J. J. V. Connaughton and M. J. Railing. May 10th.
13,279. "Cut-out devices for magneto-electric machines." A. M. Allen and R. B. North. May 10th.
13,280. "Magneto-electric machines." A. M. Allen and R. B. North. May 10th.
13,288. "Thermionic devices." W. Fitze, Ges. fur Drahtlose Telegraphie, and A. Meissner. May 10th.
13,294. "Electro-magnetic radiation or induction." W. E. Hitch. May 11th.
13,304. "Electrically-propelled ships." R. MacGregor. May 11th.
13,335. "Electrical apparatus for remagnetising magnets." S. H. Best. May 11th.
13,336. "Sparking plug." R. Bosch Akt.-Ges. May 11th. (Germany, June 17th, 1920.)
13,348. "Interlinking electric power stations." A. M. Taylor. February 2nd.
13,349. "Electrical distribution in alternating-current systems." A. M. Taylor. February 7th.
13,350. "Electrical distribution in alternating-current systems." A. M. Taylor. February 9th.
13,351. "Electric combined lock and bolt." E. J. Francis and W. Francis. May 11th.
13,355. "Electric resistances." J. J. J. M. Kluijtmans. May 11th.
13,369. "Spring couplings for electric locomotives, &c." F. Krupp Akt.-Ges. May 11th. (Germany, May 28th, 1920.)
13,381. "Thermal relays." Metropolitan-Vickers Electrical Co., Ltd. May 11th. (Germany, June 3rd, 1920.)
13,391. "Current-distributors of electric ignition systems." J. H. Runbaken. May 11th.
13,398/13,399. "Electric accumulators." W. O. Garbutt. May 11th.
13,405. "Incandescent electric lamps." K. Kambayashi. May 11th.
13,406. "Thermo-couple manometers." K. Kambayashi. May 11th.
13,425. "Systems for producing electrical oscillations." British Thomson-Houston Co., Ltd. (General Electric Co.). May 11th.
13,426. "Electric discharge devices." British Thomson-Houston Co., Ltd. (General Electric Co.). May 11th.
13,427. "Regulating systems for dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). May 11th.
13,441. "Commutators for electric ignition systems." F. W. Baker. May 12th.
13,467. "Device for recording and checking telephone calls." C. W. Cooke, J. E. Copeland, W. Rogers, J. G. Sutherland and W. C. Sutherland. May 12th.
13,487. "Apparatus for protecting electric supply circuits comprising aerial lines." Akt.-Ges. Brown, Boveri et Cie. May 12th. (Germany, May 15th, 1920.)
13,488. "Commutation of a commutating electric machine." K. Nobuhara. May 12th.
13,492. "Transforming an alternating electric supply to a supply having a larger number of phases." S. A. Stigant. May 12th.
13,495. "Method of distributing electrical power." R. W. Cowin. May 12th.
13,497. "Electric furnaces." L. J. Hancock and T. R. Hancock. May 12th.
13,513. "Automatic telephony." L. Turcat. May 12th. (France, May 12th, 1920.)
13,516. "Attachment for electric lamps, lamp-holders, &c." F. W. Salway. May 12th.
13,521. "Relays." S. M. Day. May 12th.
13,557. "Device for explanation of construction, &c., of electric armatures." C. B. Brook. May 13th.
13,559. "Resistance element for electric heating, &c., apparatus." J. K. Catterson-Smith and C. W. Stopford. May 13th.
13,561. "Earphone." V. A. Foot. May 13th.
13,566. "Methods for controlling relative phases of alternating current." W. H. Eccles. May 13th.
13,572. "Wiring systems for electric light and power installations." L. J. Lepine. May 13th.
13,596. "Electric switches." A. Reyrolle & Co., Ltd., and J. Schuil. May 13th.
13,601. "Lapping strips of paper, &c., on electric conductors, &c." C. J. Beaver and E. A. Claremont. May 13th.
13,604. "Universal relays." General Railway Signal Co. May 13th. (United States, July 19th, 1920.)
13,619. "Cooling arrangements for dynamo-electric machines." Metropolitan-Vickers Electrical Co., Ltd. May 13th. (United States, May 17th, 1920.)
13,621. "Process for obtaining deposits of iron by electrolysis." Soc. d'Electro-Chimie et d'Electro-Metallurgie. May 13th. (France, June 9th, 1920.)
13,622. "Process for obtaining metallic electrolytic deposits easily detachable from the cathode." Soc. d'Electro-Chimie et d'Electro-Metallurgie. May 13th. (France, June 18th, 1920.)
13,630. "Electric signalling." B. Davies, Eastern Telegraph Co., Ltd., and F. Ryan. May 13th.
13,642. "Electric railway trains with refrigerator cars." Akt.-Ges. der Maschinenfabriken Escher, Wyss, et Cie. May 13th. (Switzerland, May 25th, 1920.)
13,657. "Device for automatic synchronisation of electric clocks, &c." C. W. Hirst. May 13th.
13,665. "Magnetic clutches, &c." J. W. Hall. May 13th.
13,666. "Electrically-heated vulcanisers." H. Frost & Co., Ltd., and W. H. Welch. May 13th.
13,668. "Current-collecting shoes." H. E. Gaze and J. D. Twinberrow. May 13th.
13,671. "Automatic reversing switch, &c., for dynamo-electric machines." A. H. Darker and J. Stone & Co., Ltd. May 13th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1919.

20,368. "Combined electric bell and battery." S. R. Brown. August 19th, 1919. (162,310.)
21,585. "Electrodes for electrical accumulators." M. Kreher. November 3rd, 1917. (132,259.)
28,796. "Contacts for electrical switches, switch fuses, plug connectors, and the like." H. F. Shanahan. November 20th, 1919. (162,330.)
32,244. "Thermionic valves." H. St. J. De A. Donisthorpe. December 23rd, 1919. (162,338.)
32,576. "Magnetos." American Bosch Magneto Corporation. February 20th, 1919. (139,152.)
32,597. "Magnetos for multicylinder engines." American Bosch Magneto Corporation. March 27th, 1919. (Addition to 139,152.) (140,748.)

1920.

1,810. "Rotary apparatus for converting electric currents." British Thomson-Houston Co., Ltd. (General Electric Co.). January 30th, 1920. (162,353.)
2,029. "Mouthpieces for telephone transmitters." G. A. Lines. January 22nd, 1920. (162,356.)
2,338. "Electric valves or tubes for use in wireless telegraphy and telephony." A. K. Macrorie, C. L. Fortescue, G. B. Bryan and H. M. Airey. January 23rd, 1920. (162,367.)
2,501. "Burglar and like alarms." A. V. I. Bond. January 27th, 1920. (162,379.)
2,710. "Electro-deposition of metals upon iron and alloys of iron." R. J. Fletcher. January 28th, 1920. (162,391.)
2,822. "Electric transformer arrangement." F. E. Berry. January 29th, 1920. (162,394.)
3,313. "Electro-magnetically-operated valve-mechanism for internal-combustion engines." W. C. Harrigan and R. A. Lye. February 3rd, 1920. (162,412.)
3,446. "Alternating current induction motors." Aktieselskabet Jydsk Elektro. February 4th, 1920. (Addition to 141,671.) (162,415.)
4,103. "Apparatus for use in testing electric lamps, fuses, sparking plugs, and induction coils." W. S. Wolff. February 10th, 1920. (162,428.)
5,025. "Electrical distribution fuse boards, fuse boxes, and the like." Midland Electric Manufacturing Co., Ltd., and H. E. Sutherland. February 13th, 1920. (162,449.)
5,442. "Carbon-brushes for dynamo-electric machines." W. W. Jarvis and Morgan Crucible Co., Ltd. February 23rd, 1920. (162,461.)
5,644. "Mine signalling apparatus." T. H. Hill. February 25th, 1920. (162,465.)
5,816. "Vapour arc lamps." Siemens & Halske Akt.-Ges. July 26th, 1918. (139,506.)
5,904. "Fuse boxes, switch gear, and other electrical gear contained in boxes or cases." F. W. Abbott. February 27th, 1920. (162,470.)
5,949. "Alternating current electric instruments for indicating synchronism power factor, phase difference, or the like." Nalder Bros. & Thompson, Ltd., and C. L. Lipman. February 27th, 1920. (162,471.)
6,543. "Code-signalling arrangements for party-line telephone systems." Automatic Telephone Manufacturing Co., Ltd. June 30th, 1919. (146,079.)
7,046. "Electro-magnetic device for re-magnetising permanent magnets." G. A. Foehl. March 20th, 1918. (140,674.)
7,699. "Electric fuse holders." F. Shergold and A. H. Maxwell. March 15th, 1920. (162,487.)
10,748. "Method of preventing injurious earthing currents in electrical nets." Akt.-Ges. Brown, Boveri et Cie. April 17th, 1919. (141,756.)
11,894. "Machine switching telephone exchange systems." Western Electric Co., Ltd. September 14th, 1917. (142,488.)
12,835. "Incandescent cathode rectifiers for alternating currents." Naamlooze Venootschap Philip's Gloeilampenfabrieken. December 2nd, 1919. (154,872.)
13,216. "Electric switches." S. E. Hall and W. Hall. May 13th, 1920. (162,546.)
13,969. "Dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd., and P. H. H. Jantzen. May 20th, 1920. (Addition to 146,624.) (162,582.)
14,105. "Electrical apparatus for railway signalling." Tyer & Co., Ltd., and F. Downes. May 21st, 1920. (162,553.)
16,726. "Process for electrical gas purification." Metallbank und Metallurgische Ges. Akt.-Ges. & E. Lilienfeld. August 8th, 1918. (145,477.)
16,373. "Joint-covering sections of electric cable conduits." T. Wragg & Sons, Ltd., and F. J. Aubrey. July 2nd, 1920. (162,579.)
19,802. "Building commutators for dynamo-electric machines." V. G. Apple. January 22nd, 1917. (147,774.)
19,862. "Enclosed electric arc devices." British Thomson-Houston Co., Ltd. October 30th, 1915. (147,817.)
23,030. "Electric emergency lighting installations." P. Das. August 5th, 1920. (162,587.)
25,046. "Receiving apparatus for electrical oscillation." Ges. fur Drahtlose Telegraphie. September 6th, 1919. (150,701.)
26,830. "Cut-outs for electrical circuits." M. Grob & Co. September 20th, 1919. (151,285.)
27,561. "Thermal relays for use in electrical circuits." Metropolitan-Vickers Electrical Co., Ltd. October 6th, 1919. (152,024.)
28,861. "Motor controllers." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). October 12th, 1920. (162,596.)
31,331. "Transmission dynamometers." F. Krupp Akt.-Ges. November 27th, 1919. (Addition to 147,137.) (154,581.)
33,684. "Spring contacts for electric fuse-carriers and like electric fittings." W. T. Henley's Telegraph Works Co., Ltd., and W. S. Wakefield. November 29th, 1920. (162,602.)
35,340. "Electric coupling devices." S. E. Smith. December 15th, 1920. (162,606.)

Railway Construction in Japan.—In the course of an authoritative survey of the railway construction and extensions in progress or projected in Japan appearing in the *Far East Commercial Supplement*, it is stated that the boring of the Tan-na-Yama tunnel has been commenced, headings having been made 4,007 feet long at the eastern end, and 4,315 feet at the western end. For excavating, pneumatic excavators are used, with an air-compressor placed at each end of the tunnel. For carrying building materials and transporting excavated earth, a light railway of 2 ft. 6 in. gauge is to be laid, electric locomotives hauling the trains. An electric generating station is to be built to supply the power at the western entrance of the tunnel. Till the completion of this generating station, the compressed air required by the pneumatic excavators is to be supplied by steam engines placed at both sides of the tunnel. Further details of the railway construction work contained in the article may be inspected by United Kingdom firms interested on application to the Enquiry Room, Department of Overseas Trade, 35, Old Queen Street, Westminster, S.W.1.